

LAMIALES

The order Lamiales are rich in species, important to the ecology of most of the world's habitats and significant in the human economy. STEVENS *loc. cit.* reckons the size of the order at 23 families, 1059 genera, and 23,275 species.

Among the characteristic vegetative features of the Lamiales are opposite leaves that lack stipules but nonetheless bear a sharp scar across the flattened node, the result of the paired leaf bases clasping the apical meristem during early growth. Ventilation is most often pinnate and regular, although palmate or three-nerved venation is found in, for example, *Gmelina* and palmately compound leaves are found in many Lamiaceae such as *Vitex* and also among the American Bignoniaceae such as *Tabebuia*. Chemistry is variable and notable with strong characteristic odors especially prevalent among the mints and vervains. The flower in most of the Lamiales displays a perianth in two whorls of five parts; the corolla is fused in the lower part (many of the families are from the old order Tubiflorae), while the corolla lobes are zygomorphic and lipped, two lobes above and three below. The five stamens are in a single whorl and often reduced in number to four or two; the ovary consist of two carpels. You can keep the Oleaceae and Carlemanniaceae in the

back of your mind as being Lamiales without lipped flowers.

Current analysis leads to significant and long anticipated changes: Vervains (Verbenaceae) much reduced to the point where they are scarcely represented in tropical Asia at all with the most obvious examples being the naturalized weeds of *Lantana* and *Stachytarpheta*. A good introduction to the order is found in Kaderiet, and Richard Ormstedt and colleagues are developing a complete checklist on the internet. The phylogeny below follows STEVENS *loc. cit.*

Much of the richness, diversity and abundance of the order lies in the North Temperate Zone. By contrast, the order is decidedly unimportant among shade loving trees of the lowland equatorial forests. The Oleaceae, more or less basal in the order are often shade-loving small trees of the lowland forests, but these are nowhere abundant. More typical are Bignoniaceae and Lamiaceae which either reach dominance in the strongly dry-seasonal tropics (Bignoniaceae and *Tectona*, *Gmelina*, and *Premna* of the Lamiaceae) or in full sun along forests margins and large gaps (*Vitex*, *Callicarpa*, and *Clerodendrum*, of the Lamiaceae). The tendency toward a ruderal habit in the lowland equatorial tropics is also suggested by the common and widespread mangroves *Acanthus* and *Avicennia* (Acanthaceae) and *Dolichandrone* (Bignoniaceae), and in the back mangroves, *Clerodendrum* (Lamiaceae). These mangroves find their sister taxa not among the nearby gap and forest-margin species of the equatorial forests but in the dry-seasonal parts of the Mainland SE Asia.

Kadereit, J. (ed.) 2004. The Families and Genera of Vascular Plants. 7.
Olmstead *et al.* 2008. A Synoptical Classification of the Lamiales. (<http://depts.washington.edu>)

Phylogeny of Lamiales

	Family	Diversity & Distribution	Trees of Tropical Asia
	Plocospermataceae	1/1, shrub, C America.	0
	Oleaceae	25/600, woody plants, global.	8/60, mostly <i>Chionanthus</i> .
	Tetrachondraceae	2/3 herbs, disjunct, Australia & America.	0
	Calceolariaceae	2/260, herbs, S America, New Zealand.	0
	Gesneriaceae	140/3500, herbs, weak shrubs, subtropical and tropical worldwide.	1/15, <i>Cyrtandra</i> , many other species and genera as herbs.
	Carlemanniaceae	2/5, Himalayas to tropical Asia.	2/3, rare small shrubs.
	Acanthaceae	225/3500, pantropical, especially America.	2/7, mangroves, <i>Acanthus</i> , <i>Avicennia</i> .
	Lamiaceae	236/7173, global.	
	Verbenaceae	30/1100, pantropical, herbs, shrubs.	1/1, <i>Lantana indica</i> .
	Bignoniaceae	104/860, global tropical, a few subtropical.	
	Scrophulariaceae	52/1681, global.	4/7, small shrubs, others as herbs.
	Paulowniaceae	1/6, E Asia.	1/1, <i>Paulownia fortunei</i>
	Byblidaceae, Lentibulariaceae, Linderniaceae, Martyniaceae, Orobanchaceae, Pedaliaceae, Peltanthera, Phrymaceae, Plantaginaceae, Rehmannia, Schlegeliaceae, Stilbaceae, Thomandersiaceae,		0/0

ASTERIDS (LAMIIDS): LAMIALES

OLEACEAE

NAME: From the genus *Olea*, as below. In English as the olive or ash family.

OVERVIEW: The Oleaceae are a medium-sized family of about 600 species in 25 or fewer genera with a nearly cosmopolitan distribution comprising woody plants, mostly shrubs and small trees. They share with other members of the Lamiales opposite leaves without stipules, mostly simple (*Fraxinus* pinnately compound); the flower bears a small calyx and corolla with parts in fours. The olives differ from other Lamiales in that the flower is radially symmetric, the stamens often reduced to two, the superior ovary comprises two carpels but is the most variable of floral organs especially at maturity where the fruit may be a drupe, a lobed berry, a winged samara or a dehiscent capsule with winged seeds.

While strongly monophyletic, the olive family is more than a little heterogeneous in ways that are not yet fully resolved. A study across all genera of two non-coding chloroplast loci recognized nine clades represented as five tribes, one of which, the olive and ash group itself, with four constituent subtribes¹. The distribution is patchily cosmopolitan and perhaps reflects the ancient origin of the family: it is considered sister the rest of the Lamiales.

The tropical olives of the genus *Chionanthus* are consistent elements of the lowland equatorial forests, the mid montane forests and are perhaps equally at home, though with fewer species, in the dry-seasonal lands. However, they seem to be nowhere abundant. It is not surprising then that little is known their native ecology. A starting point is the family treatment for Sabah and Sarawak by Ruth Kiew².

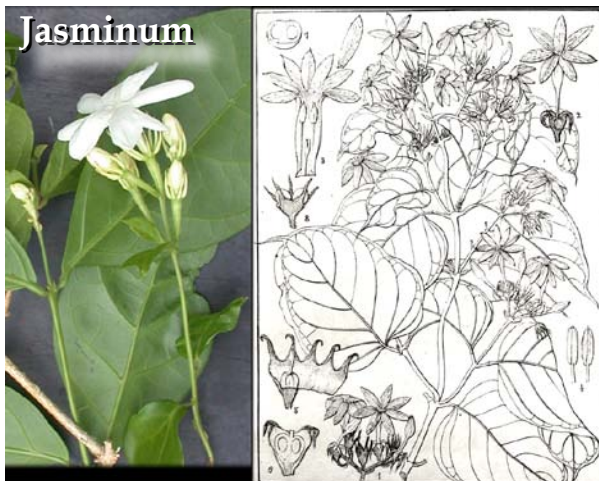
NYCTANTHES. [Greek, night flowering.] Two species, *Nyctanthes aculeata* and *N. arbor-tristis*. Other species formerly here have been transferred to *Jasminum*. *Nyctanthes* species are small trees of less than 10 m height. The fruit is a two-part capsule, with a single seed in each part.

JASMINUM. [Derived from a Middle Eastern name, probably Persian.] With more than 450 species, mostly Paletropical, mostly thin lianas and a few scandent shrubs. About 50-80 species in tropical Asia, doubtfully any are truly

free standing trees, but they are among the common thin lianas. *Jasminum sambac* may be the most accessible representative of the family in tropical Asia. This is the *sampaguita*, the national flower of the Philippines since 1937; it is called *melati* in Malaysia. Indonesia named it one of the three National Flowers in 1990. The name jasmine is also indiscriminately applied to a variety of white fragrant flowers including *Gelsemium*, *Gardenia* and various Apocynaceae.

LIGUSTRUM. [Classical name for *Ligustrum vulgare*, known in English as the privet.] About 40 species, especially in northern Asia, extending to Europe, and Australia. In general, these are outwardly similar to *Chionanthus*, but the inflorescence is a large terminal panicle. Additionally the wood anatomy indicates a basal position among the *Olea* group, and there is some evidence that *Ligustrum* is embedded within *Syringa*. In tropical Asia, one species, *Ligustrum glomeratum*, is fairly common and widespread with a remarkably wide ecological amplitude, found from lowlands to mountains near 1600 meters. In the Philippines, two other uncommon species are claimed, *L. cumingianum* and *L. stenophyllum*, the latter known only from the type collection from Isabella, Luzon. Mainland SE Asia claims several other species, and the northern species, *L. sinense*, is cultivated in hill stations.

SCHREBERA. [Commemorates J. van Schreber, German botanist, d. 1810.] A genus of 24 African species with two additional and strangely disjunct species, one in Borneo and one in Peru. Little is known of *S. kusnotoi*, the type only described in 1953 from Kalimantan and a few other collections have been made in Sabah. *Schrebera* looks superficially like Bignoniaceae.



Jasminum. Left, the ordinary form of the *sampaguita*, *J. sambac*; right, *J. malabaricum*, a scrambling lianas from India. (Drawing adapted from WIGHT loc. cit.)

Wallander, E. et al. 2000. American Journal of Botany. 87: 1827-1841.

Kiew, R. 2002. Tree Flora of Sabah and Sarawak. 4: 129-168.

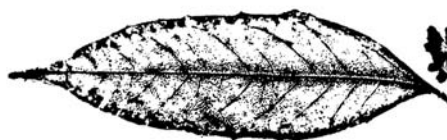


Ligustrum cumingianum, Mingan, Philippines; note the four corolla lobes, longer than the tube, the long exerted stamens. (© Leonardo L. Co).

FRAXINUS. [Latin, classical name of the ash tree.] 65 species, two or three in tropical Asia. The ashes are usually medium sized deciduous or semi-evergreen trees with opposite pinnately-compound leaves. A few species of the Temperate Zone bear simple leaves. The fruit are distinctive dry winged (known in English as keys). The name ash comes from Old English and relates to spears



Fraxinus griffithii. Drawing based on the type specimen of *F. philippinensis*, collected in Rizal Province, Luzon Island; opposite compound leaves with a flattened swollen node.



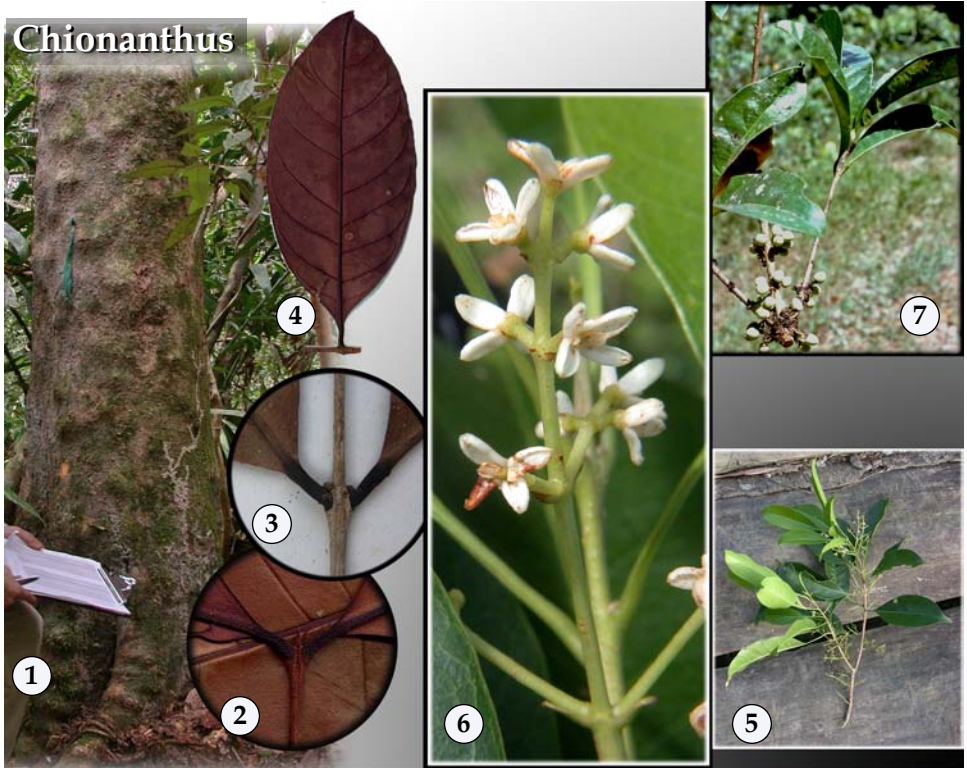
Olea. Above, *O. palawanensis* from Mt. Bloomfield, Palawan, Philippines; below, tracing of *O. rosea*. (Photograph © Leonardo L. Co.)

made of ash wood which has always been valued for its hardness and fine straight grain.

The Asian tropical species include the Himalayan ash, *Fraxinus floribunda*, found at 1000-2000 m in rich wet hillsides in Nepal eastward to Yunnan and south through Thailand at least as far as Khao Yai National Park at 800 m. *Fraxinus eedenii* grows in the mountains of Java, and *F. griffithii* (= *F. philippinensis*) from Luzon. The leaflets of the southern species are nearly sessile, slightly toothed. These could be confused with opposite compound leaves such as Bignoniaceae, or *Turpinia*. They should not be mixed with *Engelhardtia* (Juglandaceae) which has similar looking dry winged fruit, but bears spirally arranged leaves.

☞ - *Olea* Group - ☞

OLEA. [Classical name for the Mediterranean olive.] It has been suggested that the entire subtribe be treated as a single genus, but bear in mind that most of the species have never been formally named under *Olea* and the names continue to appear under the following two genera. *Olea europea* is the commercial olive, one of the most important of Mediterranean trees; *Olea* in the narrow sense includes important trees of Australia and S Africa, and of the tropics. *Olea rosea*, commonly collected shrub in Chiang Mai.



Chionanthus. 1, *C. ramiflorus*, Pasoh, 47 cm DBH; 2, 4, *C. pachyphyllus*, typical features of the dry leaf, red color, thick hard blade, black leaf stalks; 3, the black leaf stalks and white twig typical of many species; 5-6, the Philippine endemic, *C. coriaceus*, in northern Luzon, sparsely flowered inflorescences below and among the leaves, the flowers with small calyx, four white petals, evidently unisexual; *C. calophyllus* at Pasoh, the fruit axillary from axils of fallen leaves; (Photographs 3-5, adapted from photograph of Brunei voucher specimen © Professor Eizi Suzuki.)

CHIONANTHUS. [Greek, in reference to the white flowers.] A genus of about 100 species with a wide distribution, primarily in the tropics and subtropics, but with two species extending north into temperate regions, *Chionanthus retusus* in eastern Asia and *C. virginicus* (the fringetree) in eastern North America. These two northern species are deciduous, and for that reason some botanists had limited *Chionanthus* to the two deciduous, temperate species; the evergreen species were then placed in *Linociera*. Tropical Asia maybe 30 or more, Philippines six, Malaya 12, perhaps six in Mainland SE Asia. However, poorly known in general; the review of Bornean species for the *Tree Flora of Sabah and Sarawak* nearly doubled the species list from 10 to 25 with 15 newly described. Found in lowland wet forests and also the strongly dry seasonal forests. They are shrubs and small to medium-sized trees growing to 25 m tall. The

inflorescence is sparsely flowered; in contrast to the long petals of the American Fringetree, the flowers here are tiny, often no more than 4-5 mm across, with four white petals and two stamens typical of the family. The sexuality is thought to be bisexual, but field study would be useful. The fruit is a drupe containing a single seed. The most distinctive feature is the white twig set in contrast to the nearly black leaf stalk. The leaf blade is sometimes pimpled. The most common name in Borneo is *mok*.

OSMANTHUS. [Greek, in reference to the fragrant flowers.] About 30 species, generally of the warm parts of west Asia, with one species in N America. The genus differs from *Chionanthus* in that the petals are overlapping rather than free and valvate. Perhaps only *Osmanthus fragrans* extending south, or perhaps naturalized from cultivation, in the mountains of Vietnam and Thailand.

ASTERIDS (LAMIIDS): LAMIALES

CARLEMANNIACEAE

NAME: From the genus *Carlemannia*, as below.

OVERVIEW: A small family of fleshy herbs and weak stemmed shrubs, rarely reaching one cm DBH. The representation in tropical Asia is minor. The family totals only two genera and about five species native chiefly to the Himalayas, and a few are found east and southward to the northernmost mountains of Thailand, Laos, Vietnam, with *Carlemannia tetragona* disjunct in Gunung Leuser in Sumatra^{1,2}. The family is characterized by opposite, leaves with toothed margins, and flowers that are weakly asymmetric or hardly at all, two stamens and an inferior, bicarpellate ovary. The two genera are either perennial herbs with four-part flowers and dry two-part capsules that separate at the locules (*Carlemannia*) or multi-branched shrubs with five-part flowers (heterostylous) and fleshy white capsule opening by five longitudinal valves (*Silvianthus*).

These plants were long thought to be weird allies of the Rubiaceae. However, the present position within the Lamiales is recommended by the toothed blade margin, a node that lacks stipules and yet bears a scar across the twig, and the two stamens. The placement is tentatively bolstered by molecular studies.

SILVIANTHUS. [A Hooker creation that hybridizes the name of an unidentified person, Silvia, with the Greek for flower.] These are small shrubs have the family characters of opposite toothed leaves and the axillary and densely flowered inflorescence. *Silvianthus bracteatus* and *Silvianthus tonkinensis* are found in the high mountains of Mainland SE Asia, sometimes commingling with vegetatively similar Chloranthaceae.

¹Yang, X. *et al.* 2007. Chinese Science Bulletin. 52: 244-250.

²Tange, C. 1998. Thai Forest Bulletin. 26:59-65.



Silvianthus bracteatus, from Hooker's *Icones Plantarum*, vol 11.

CARLEMANNIA. [Commemorates C. Lemann, d. 1852, English botanist.] Maybe three species, poorly known, and hardly more than perennial herbs. *Carlemannia tetragona* is in the mountains of Mainland SE Asia and once in Sumatra. These plants rarely reach a height of two m; the leaves are said to be fragrant when dry.

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ASTERIDS (LAMIIDS): LAMIALES

ACANTHACEAE

NAME: From the genus *Acanthus*, as below.

OVERVIEW: The Acanthaceae are a species-rich family comprising for the most part small shrubs and herbs and lianas. The estimate of 3500 species may yet be augmented by many undescribed species in the Neotropics, while the current total of 229 genera will likely be greatly reduced by continued phylogenetic studies^{1,2}. Though the family is a critical part of the understory shrub flora of the Neotropics, it is represented in tropical Asia almost entirely by herbs and lianas, with the important exception of the black mangroves, *Avicennia*, which is newly placed in the family³, and divergent for many

characteristic family traits and so a brief description of the family is in order despite the minimal representation among trees.

The family is characteristic of the order Lamiales in the opposite simple leaves, flowers two-lipped (upper lip missing in *Acanthus*), stamens that number two or four, commonly with one or more staminodes. The flower of such Acanthaceae as the common lianas of *Thunbergia* are scarcely different from other Lamiales with two-lipped corollas. One distinctive feature of the Acanthaceae is that one anther lobe is often smaller than other. However, the feature that most decisively separates most Acanthaceae lies in the relatively unique fruit. At matu-

¹Scotland, R. *et al.* 2000. Kew Bulletin 55: 513 – 589.

²Schwarzbach, A. *et al.* 2002. Systematic Botany. 27: 84–98.

³McDade, C. *et al.* 2008. American Journal of Botany. 95: 1136-1152.

urity the two-celled capsule splits apart. The funiculus of each seed has meanwhile swollen and dried under tension and as the fruit opens, the flat unwinged seed is thrown several meters away. You might have a look at the cultivated species of *Justicia* and *Barleria* to see what most Acanthaceae look like.

China claims about 60 genera and 300 species, while equatorial Asia claims less than 30 genera overall. The fairly complete checklist for Brunei includes 13 native genera, about 25 species, all herbs except for those treated here. Perhaps *Borneacanthus grandifolius* could be added as possibly reaching one cm DBH. Nonetheless, you could walk the forests from Bangkok to Bali and never see an Acanthaceae that was more than knee-high. The many large-scale forest plots of Asia enumerated more than a million woody plants larger than one cm DBH, and recorded not a single Acanthaceae.

Rather than forest trees, the Acanthaceae of tropical Asia are of three sorts. First, we find many mountain Acanthaceae - streamside herbs whose leaves are blistered with what appears to be embedded grains of sand and bearing magnificent violet flowers. These are poorly collected and poorly known. Second we have the abundant lianas of *Thunbergia*, native species and aggressive invasive species. And third, the important mangroves of the genus *Avicennia*. These trees, while clearly in the Lamiales, evince many peculiarities of form, such that their nearest relatives have been the subject of debate for over a century. The traditional placement in Verbenaceae was demonstrably wrong on both morphological and molecular evidence. The evidence of an origin within the Acanthaceae, sister to *Thunbergia*, is based on sequences from chloroplasts and nuclear ribosomes, and has recently been confirmed.

AVICENNIA. [Commemorates the medieval Persian scholar Avicenna, author of the 14-volume *Cannon of Medicine*.] The widely used Malay name, *api-api*, probably refers to its use in smoking fish, rather than as a fire wood, for which purpose it is not very sound. The genus *Avicennia* is the most ubiquitous and consistent of mangroves. Three to five species with white flowers are shared between the Neotropics and West Africa, and another five from east Africa throughout the Asian tropics, these with bright orange flowers⁴. The identity and description of individual species has recently been clarified⁵.

Avicennia species grow as columnar trees to a height of 30 m, or as small multi-branched shrubs, sometimes sprouting from the trunk of older trees. They are quickly distinguished from other mangroves by the columnar stem without prop roots but with strong pneumatophore; by paired opposite and well-stalked leaves that join at the leaf stalk over the apical bud, by the whitish



Some of the most obvious members of the Acanthaceae in Asia are cultivated plants from the American tropics, such as *Justicia carnea* above, clonally sreading (but not naturalized) here on the forest margins of Mt. Makiling, Philippines. Scenes such as this are characteristic of the Neotropical forest understorey, but are not to be found in most of Asia.

lower surface (thinly with a layer of salt - fold and keep it in your mouth for a moment), by the margin of the blade without trace of serration or glands, without punctate glands or odor. Like most mangroves, they seem to flower or fruit episodically throughout the year. The fruit is a thin-walled dry capsule, filled with the thick green cotyledons of the single seed. The capsule splits as the seed germinates viviparously.

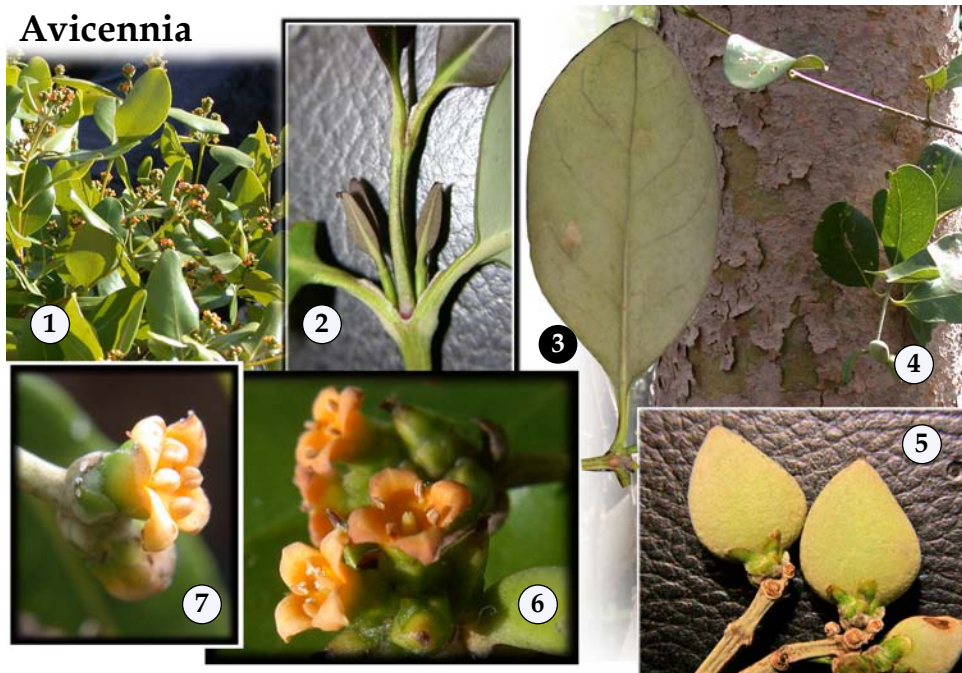
The comparative field biology is not well known. Of particular interest would be segregation of the sympatric species by soil and salt requirements.

ACANTHUS. [Greek, spiny.] The genus *Acanthus* includes about 30 species of soft-bodied shrubs with spiny leaves, found chiefly in the strongly dry seasonal parts of the Old World. Three species occupy the tropical mangroves, one or more of which are found abundantly in most mangroves in tropical Asia. Typically, they are found in standing water at the edge of muddy banks where they form dense clonal patches, from one to two or more m tall. The larger stems bear terminal spikes of flowers. The color differs among the species; the pollination of this common plant is surprisingly undocumented, but sunbirds and large bees are obvious visitors. The capsules are large with four large seeds, dispersed ballistically, then floating.

⁴Tomlinson, P. 1986. The Botany of Mangroves.

⁵Duke, N. 1991. Australian Systematic Botany 4: 299-324.

Avicennia



Avicennia. 1-6, *A. marina*, Philippines; 1, habit, dense opposite leaves, glossy above, white below, dense clusters of small orange flowers; 2, the paired opposite leaves are initially joined by the leaf stalk which results in scars along the lower leaf stalk edge and across the twig; 3, the blade of this species is blunt, the venation distinctive; 4, the bark of this species is characteristic, a muddy gray that breaks apart in small flakes; 5, the small fruits are flattened cones, dull tan and thinly hairy, the single seed within fills the fruit with the large green cotyledons; 6-7, the 4-parted flowers, of two populations, differing in anther size, possibly fertility?

Acanthus



Acanthus ilicifolius. To the left, the terminal spikes of flowers and fruits; center, the paired leaves with a scar across the node, the blade with scalloped margins, the spines from the main nerves; right, the flower with a single corolla lobe.

LAMIACEAE

NAME: The family name Lamiaceae follows the genus of European herbs, *Lamium*, based on Greek for throat. The old and alternative family name is Labiatae, which is not based on a genus, but rather from the Greek for lip-bearing in reference to the obvious floral feature. In English, this is the mint family.

OVERVIEW: A large family of 236 genera and 7173 species, with a cosmopolitan distribution^{1,2}. The bulk of species richness is found among herbaceous perennials of the North Temperate Zone where the family contributes a great many traditional medicines and culinary flavorings such as sage, peppermint, basil, and oregano. Among trees of tropical Asia, the Lamiaceae are represented by about 13 genera and around 120 species. Most are small trees and shrubs of the full sun, and especially abundant and species-rich between 10–20 degrees North latitude in dry seasonal climates. A few species, including teak, *Gmelina* and *Vitex*, reach large diameters. Within the shaded lowland equatorial forests, we find *Teijsmanniodendron*, which is more or less restricted to that habitat, together with a few species of *Clerodendrum*, a genus more prevalent at higher latitudes. The family is also represented in tropical Asia by several abundant lianas and a number of herbs, especially in the dry seasonal lands.

The Lamiaceae have recently seen significant reorganization at all levels; the names and circumscription of many subfamilies, genera and species are new³. Traditionally, the Lamiaceae and Verbenaceae were viewed as a pair of naturally related but distinct families that share a squarish stem, opposite leaves that lack a stipule but display a scar at the node, a lipped flower, and an ovary with two carpels, each with two ovules. They were thought to differ in the form of the ovary. Among the narrowly defined mints, the ovary is deeply four-lobed and the style attaches from the base, whereas in the Verbenaceae, the ovary is unlobed and the style is terminal. Cladistic studies demonstrated that such differences arose more than once and that the phylogeny of the many plants among the family pair is more complicated. The current convention is to treat the Lamiaceae broadly and restrict the Verbenaceae very narrowly, while the genus of mangroves, *Avicennia*, moves to the Acanthaceae. Most of the trees of tropical Asia treated here under the Lamiaceae will be found in the Verbenaceae in books written prior to about 1985.

Lamiaceae are famously rich in aromatic compounds. The leaves are notably variable: either simple with pin-

nate venation as in *Callicarpa*, or with a three-nerved base as in many *Gmelina* and *Clerodendrum*, or palmately compound with three to five leaflets (*Vitex*) or, less commonly, pinnately compound (*Peronema*). The blade margin is either entire or toothed. The calyx varies as to whether it is cup-shaped or somewhat lipped and lobed; the corolla likewise varies in the degree of asymmetry and the number of lobes. The ovary is variable in form and even more variable as it matures to a fruit.

Our knowledge of the ecology of these trees is poor, especially with regard to the comparative ecophysiology of light and water relations. While many are plants of the full sun, common in degraded lands and along roadside, they are by no means fast-growing, and so cannot be likened to trees such as *Macaranga*. An unusual contrasting ecology is seen in *Teijsmanniodendron* which occupies the shaded forests of Borneo. By what trick has it found a way to exploit a habitat that seems so unsuited to other Lamiaceae? Does its secret relate to the swollen pulvini of the leaflet stalks? More broadly, we would like to know how the wide variation in leaf venation among the genera of Lamiaceae relates to ecology.

While the flowers of mints, tropical and otherwise, have a general two-lipped form with a two+three arrangement of the corolla lobes, the larger lobes providing a landing pad for insects, the complementary lobes arched to protect the stamens which dust the back of the visitor. However, the details of floral form and color vary widely. In symmetry, *Callicarpa* is nearly actinomorphic; the corolla tube can be short or exceedingly long as in *Clerodendrum*, while the petal shape varies greatly in detail. All of which suggests a critical role for the co-evolution of pollinators. Yet surprisingly little is written of pollination among these accessible tropical trees.

FIELD RECOGNITION

Without exudate; the bark is most often white or gray, thin, and typically with a green inner bark.

Aldehydes present and many individual species with characteristic odor, sometimes rank and foetid, sometimes pleasantly minty.

The leaves are opposite decussate, variable by genus as to simple, palmately compound or pinnately compound; and likewise pinnately nerved or palmately nerved.

The youngest twigs are somewhat squared although not so much as in the herbaceous mints; more decidedly the node is flattened, without a stipule but the leaf pairs crowd the apex in such a way as to create a characteristic scar across the mature node.

Many species have a toothed leaflet margin.

FIELD CONFUSION

The most obvious mistake is to confuse opposite tri-foliate *Vitex* with opposite tri-foliate *Melicope* (Rutaceae), the Lamiaceae always bear a characteristic line or scar across the node, lacking in the Rutaceae; the odor of the two are very different.

Simple leaved species can be confused with *Mastixia*, or *Viburnum*; but note the characteristic flattened node with a line and the stellate hairs of *Callicarpa*.

Memecylon and *Melastomataceae* also bear such a scar but in those the node is not flattened and the leaves are entirely different.

¹Harley, R. *et al.* 2004. Families and Genera of Vascular Plants. 7: 167-276.

²Olmstead, R. *et al.* 2006-2009. A Synoptical Classification of the Lamiales. (<http://depts.washington.edu>.)

³Bramley, G. *et al.* 2009. Taxon. 58: 500-510.

*I would like to thank Dr. G. Bramley for reviewing an earlier draft and correcting several of my errors.

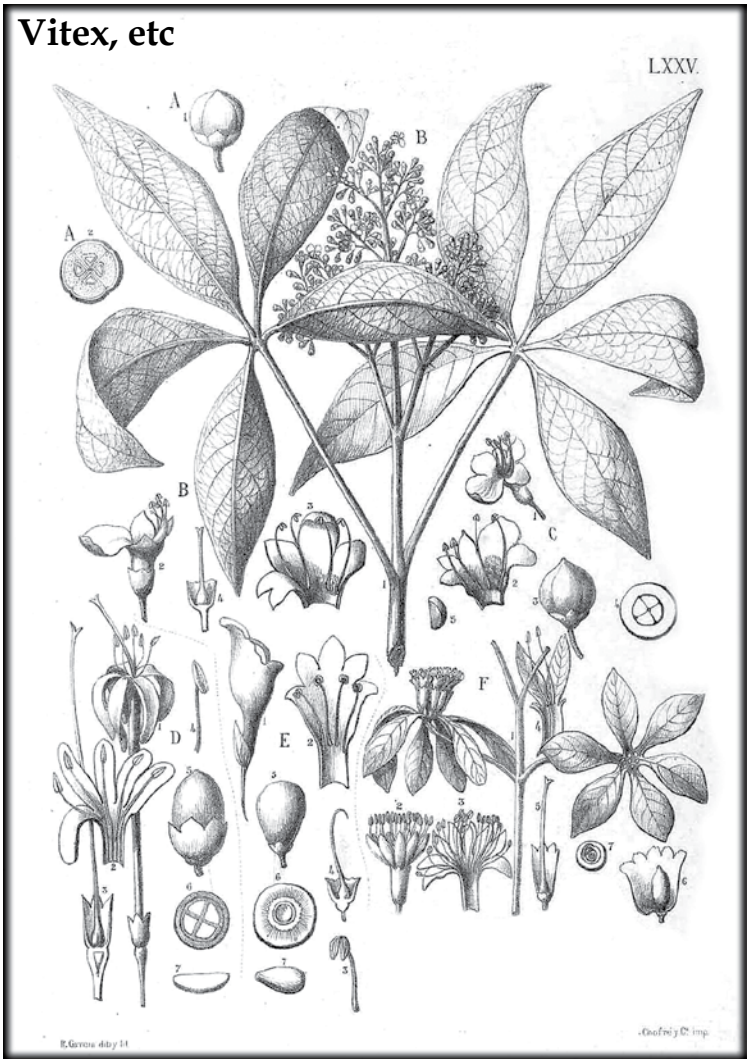
Outline of Trees of Tropical Asia in the Lamiaceae

Although recent studies cited have made significant progress in the history of the Lamiaceae, a complete phylogeny for the family is still not possible. The following is a skeletal outline to the representatives among the trees of tropical Asia, in general following Harley *et al.* as cited above¹.

Style from the base of the ovary			TTA
Lamioidae	63/1210, chiefly N	Temperate, herbs.	0
Nepetoideae	105/3675, cosmopolitan, but especially temperate herbs.		0
Style terminal			
Prostantheroideae	16/317, Australia.		0
Scutellarioideae	5/380, cosmopolitan herbs.		0
Symphorematoideae	3/27, especially <i>Symphorema</i> , 3 species, scrambling low lianas of Asia, flowers in heads with bracts.		0
<i>Vitex</i> --Group (Viticoideae) woody plant, asymmetric lipped flowers, branched hairs, 10/400..			
5-lobed corolla			
<i>Vitex</i>	leaf palmately compound, (sometimes 1 leaflet, leaf stalk swollen at base only, leaflet stalk not swollen, lipped flowers, 4 seeded fruit, trees of full sun, widely in tropical Asia especially dry seasonal.		35
<i>Teijsmanniodendron</i>	leaf palmately compound, leaflet stalk swollen, trees of lowland equatorial forest.		25
4-lobed corolla			
<i>Premna</i>	simple leaf, inflorescence terminal, calyx mostly cup-shaped, not lipped, single endocarp, 4 celled.		30-40
<i>Clerodendrum</i> -Group (Ajuquoideae) woody plant, actinomorphic flowers, simple hairs 24/1000.			
<i>Clerodendrum</i>	leaves palmately nerved or weakly 3-nerved, or at least the nerves crowd the base; large open terminal panicle of large flowers, calyx bell shaped or divided, sometimes swollen and fleshy, throughout tropical Asia, some full sun, some forest understory.		15, as trees
<i>Glossocarya</i>			3
<i>Pseudocaryopsis</i>			1
<i>Karomia</i>	simple leaves, calyx persistent papery, flat, 2-3 cm wide, rare, Vietnam .		
Unplaced 10 genera			
<i>Peronema</i>	leaf pinnately compound, leaf stalk winged, dry seasonal lands.		1
<i>Callicarpa</i>	leaves simple pinnately nerved, often white floccose below, axillary inflorescence of tiny flowers, corolla 4-lipped, 4 pyrenes, forest margins, full sun, gaps.		?
<i>Gmelina</i>	simple leaves, palmate nerved with basal glands, large lipped flower, fruit fleshy, 1-4 seeds; strongly dry seasonal, full sun.		3
<i>Tectona</i>	simple leaves, pinnate nerved, stellate hairy, inflated calyx, dry seasonal lands.		3
<i>Hymenopyramis</i>	simple leaves, calyx and corolla 4-lobed, fruit a schizocarp in inflated calyx.		6
<i>Garrettia</i>	5-lobed, perennial herb or shrub, trifoliate, serrate margins. .		1

Given the number of Lamiales that appear among our principle species of mangroves, and given that many of our Lamiaceae appear to be both salt tolerant and to enjoy the full open sun, we might expect a few species of Lamiaceae to have join the select company of true mangroves. But that proves not to be exactly true. *Clerodendrum inerme* is common in back mangroves; some *Premna* are in similar locations, and *Premna serratifolia* is one of the more common shrubs of sandy shores, joined

there by *Vitex* and a few *Gmelina*. And yet none is found primarily in standing salt water.
The economics of the family in tropical Asia suffers from an lopsided favoritism: teak and molave for timber, *Gmelina* as a fast-growing utility tree, and a few *Clerodendrum* as ornamentals. The rest of the exceptional diversity has hardly been explored for valuable products. Many species were widely used in the past as traditional medicines or for fine furniture wood.



A, *Vitex pinnata*; B, *V. quinata*; C, *V. parviflora*; D, *Clerodendrum quadriloculare*; E, *Gmelina philippensis*; F, *Symphoremia luzonicum*, a liana, but a common genus and representing a very different lineage in the Lamiaceae, here with flowers in heads subtended by bracts, the whole unit dispersing by wind. Drawing adapted from VIDAL *loc. cit.*; names follow MERRILL *loc. cit.*

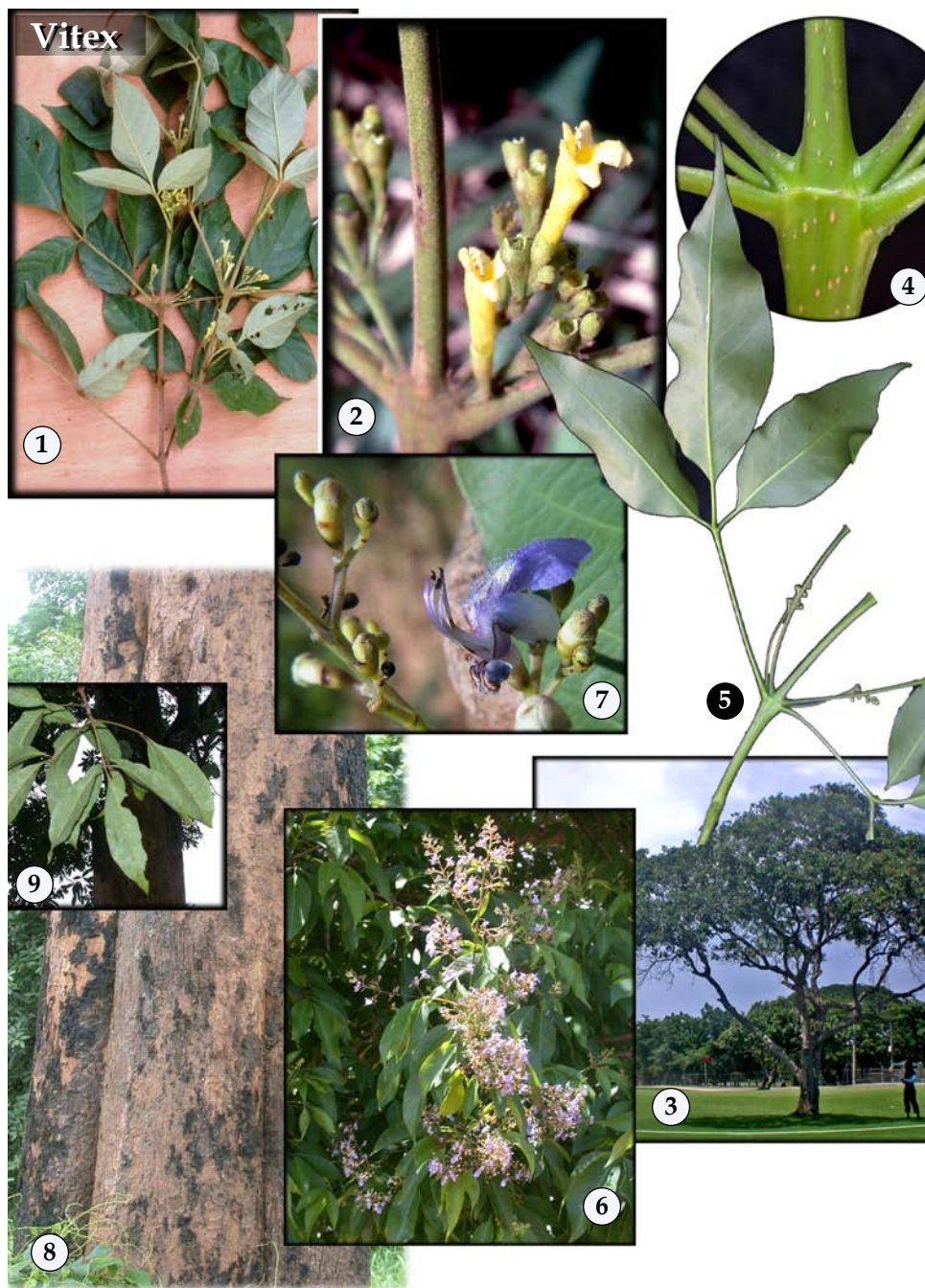
☞ - Vitex Group - ☞

VITEX. [Classical Latin for this or a similar plant.] A large and evidently paraphyletic genus of several hundred species, pantropical and subtropical, with *Vitex agnus-castus*, the Mediterranean chaste-tree, as the type species. Regional species were recently revised⁴. Malaya claims 10 species, the Philippines nine, and about 25 in Mainland SE Asia. The Malay name is *leban*, while in

Sarawak and also the Philippines *lenggundi* and *lagundi* are common.

Vitex species are woody plants, the leaves opposite and palmately compound with three to seven leaflets (if one leaflet, then the abscission scars of the other leaflets are visible). In comparison with *Teijsmanniodendron*, note that the junction between the leaf stalk and the leaflets is not swollen. If hairs are present they are never stellate. Other trees with opposite trifoliate leaves, such as *Melicope* (= *Euodia*) and perhaps a few other genera in the Rutaceae, have shiny glabrous leaves with a citrus smell. Do not confuse with cultivated *Tabebuia* (Bignoniaceae) of the American tropics.

⁴de Kok, R. 2008. Kew Bulletin 63: 17-40.



Vitex. These species all with three leaflets, other species with 5-7 leaflets. 1-2, *V. vestita*, Pasoh; 1, opposite compound leaves, pale below, short axillary inflorescence; 2, this species (and the related *V. flava*) bear tubular yellow flowers; 3-7, the *molave* tree, *V. par-viflora*, Luzon, Philippines; 3, of characteristic form, a 70-year old, formerly mixed farmland and *molave*-forest, now guarding the 8th green, Cliffs Golf Course; 4, opposite compound leaves, the leaflet stalk unswollen; 5, node with scar; 6, inflorescence; 7, violet flower with short corolla; 8, a large *Vitex* in southern, Vietnam, typical trunk with pale brown shredding bark; 9, tri-foliate, opposite compound leaves.



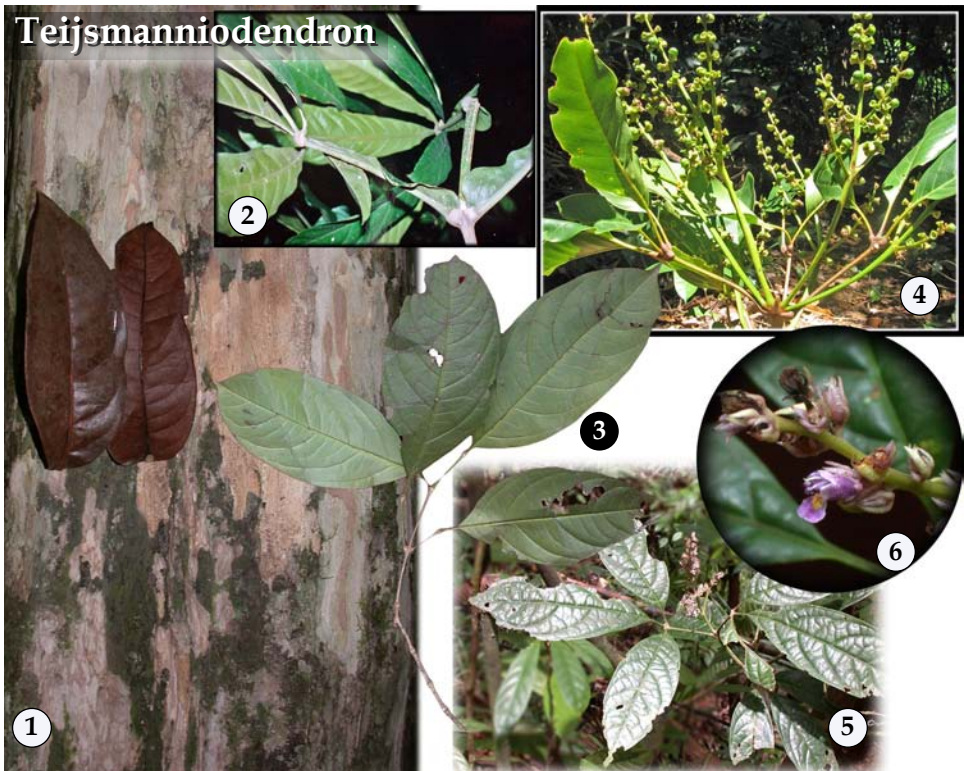
Molave is the local name in the Philippines for the tree and wood of *Vitex parviflora*; the wood is exceedingly heavy, hard and long lasting, difficult to shape, but the twisted buttresses and roots are a favorite to use in the construction of native furniture.

The recent phylogeny cited above, although with limited sampling, indicates six strongly supported clades, including three previously segregated genera, and with *Teijsmanniodendron* either nested within or sister to *Vitex* broadly.

The first clade is restricted to strongly dry seasonal lands of Mainland SE Asia on the one side, and Philippines to Australia on the other. It is significant because it include two formerly segregated genera and links them to *V. tripinnata*. The former *Paravitex siamica* differs from other *Vitex* in the single seed and mostly simple (or rather a single leaflet?) rather than palmately compound leaves. This species, or possibly a related form, was recently found by James Maxwell along the Mekong in Cambodia, which extends the known range⁵. Because the specific epithet *siamica* is occupied by *Vitex siamica*, a Malayan species, the former *Paravitex* now becomes *Vitex thailandica*. Several species in this clade were formerly named under *Viticipremna*, chiefly of the eastern region from New Guinea to Australia, but including *Viticipremna philippinensis*, which is now *Vitex turczaninowii*. Although widespread in the Philippines, the recommended common name of *lingo-lingo* is far from well known.

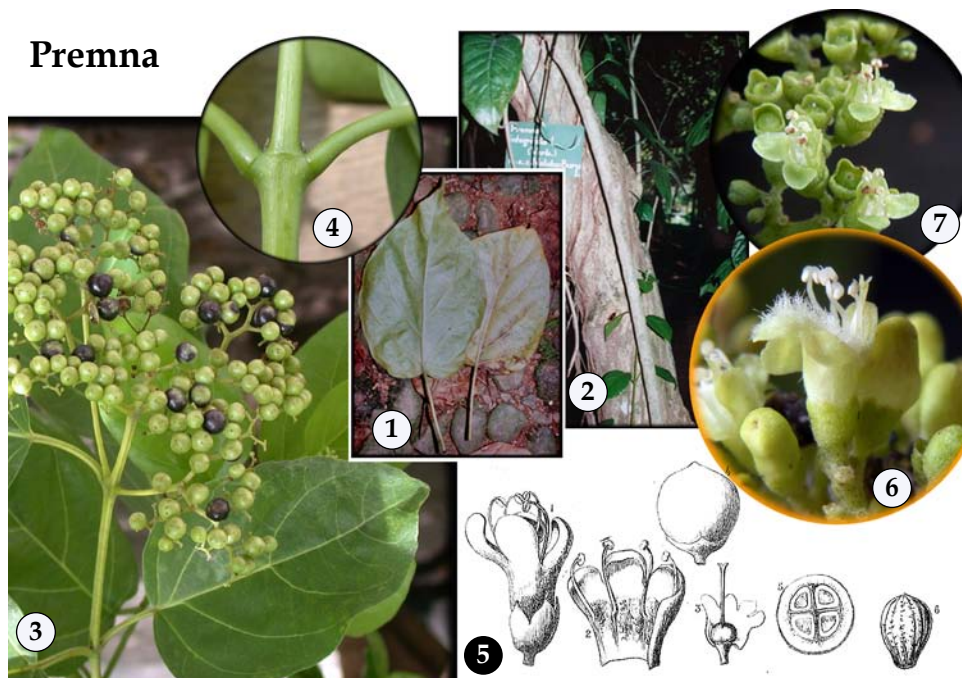
A second strong clade is distinguished by an axillary inflorescence and yellow tubular flowers. It includes several of our well-known species, *Vitex vestita*, *V. flavescescens*, *V. gamosepala*. Also included here is the former *Toongia axillariflora*, now *Vitex axillariflora*, known from China, Myanmar, and Viet-

⁵Maxwell, J. 2009. Maejo International Journal of Science and Technology. 3: 143-211.



Teijsmanniodendron. 1, *T. holtrungii*, Lambir, mature tree, 35 cm DBH, with thin shredding bark and fallen leaflets, these abscise at the leaflet base; 2, *T. pteropodum*, cultivated in Bogor Botanic Garden, with a wide winged leaf stalk, ote swellings at leaflet base; 3, *T. simplicifolia*, Lambir, the leaf with a single leaflet; 4, *T. abernianum*, Palaui, Luzon, with *Vitex*-like inflorescence, but strong swelling at leaflet base; 5-6, *T. sinclairii*, Lambir, forest understory, species distinguished by small stature, three leaflets and blistered surface, flower is similar to *Vitex*. (Photograph 4, © Ulysses Ferreras.)

Premna



Premna serratifolia. 1-2, old tree and fallen leaves, in the Bogor Botanic Gardens, sourced from Maluku, named *P. integrifolia*, taken to be a synonym; 3-4, as a small coastal shrub in fruit, Palawan, Philippines, with a detail of the node; 5, drawings of flower and fruit. (Drawings in 5 adapted from VIDAL *loc. cit.*)

nam. Leaves bear one to three or more leaflets, corolla weakly two-lipped, with elongated tube and lobes four or five.

The Mediterranean chaste-tree, *Vitex agnus-castus*, formed a clade with the abundant shrub of degraded lands, *V. negundo*, (in the Philippines, *legundi* usually applies to this), the Asian-Pacific seashore shrubs and beach lianas *V. trifolia* and *V. littoralis* (usually treated as subspecies). The three species share a peculiar type of hair - multicellular with an apical cell covered with wax plates. The three are also among the best known of those *Vitex* species with medicinal use.

Another important clade was formed by *V. pinnata* and allies that include *V. quinata* and the important *V. parviflora*. The latter is *molave*, one of the most important small timbers of the Philippines, and a small but obvious part of the original Philippines vegetation wherever the seasonality was especially strong. Making *molave* furniture is a still active traditional craft; the unique chairs and tables an important motif in Philippines home decor, while *molave* parquet flooring makes efficient use of the small size of the current timber.

TEIJSMANNIODENDRON. [Commemorates Johannes E. Teijsmann, d. 1882, Dutch botanist, collector and for nearly 40 years curator of the Buitenzorg

⁶Leeratiwong, C., *et al.* 2008. The Natural History Journal of Chulalongkorn University 8: 7-18.

Botanic Gardens; introduced cassava, cinchona and oil palm to the region.] This is a small but significant genus of about 25 species. They include some of the only Lamiaceae that are large trees and at home in the shade of the lowland equatorial forest. Apparently, all species are in Borneo, while a few species are found beyond the island: six in Malaya, two or three in Mainland SE Asia, three or four northward into the wet east coast of Mindanao, with a few populations further north into eastern Luzon; a few species reach New Guinea.

These trees are similar to *Vitex*, and possibly nested within that broad genus, but distinguished in the obvious swellings at the base of each leaflet stalk. The leaflets may number as many as seven, or as few as one in the common species *T. simplicifolia*. I have a note of unattributed source, that *Teijsmanniodendron* has vascular bundles in the twig pith, *Vitex* does not.

Most species in the genus exceed 20 cm DBH, but they are not tall trees, and many begin to flower at a small size. They regenerate abundantly in the forest shade, and show good growth rates between 10-20 cm DBH. In larger larger trees the growth appears to slow markedly.

PREMNA. [Greek, tree trunk or stump, unclear reference.] *Premna* is a Paleotropical genus that includes over 300 basionyms, representing an uncertain number of species between 50 and 200; a few are exceedingly

familiar but most names are hardly known in the least. Most species are small multi-branched shrubs of open sunny places, roadsides, riverbanks and degraded lands. *Premna serratifolia* is particularly common along sandy seashores and along muddy river banks throughout tropical Asia, sometimes recorded under what are now taken to be varied synonyms (*P. littoralis*, *P. integrifolia* and *P. corymbosa*). Some species, such as *P. obtusifolia*, are found in standing brackish water of back mangroves. *Premna odorata* is *alagao*, a native weedy shrub of the Philippines, able to live in cities where it makes a home along sidewalks and abandoned lots. The leaves yield a pleasant odor and it is one of the few arborescent Lamiaceae that contributes an herb to Asian cuisine, being especially popular in the Pampanga region. About 20 species of *Premna* are recorded for the Philippines, 15 in Malaya, about 20 in Mainland SE Asia, including a few new species⁶.

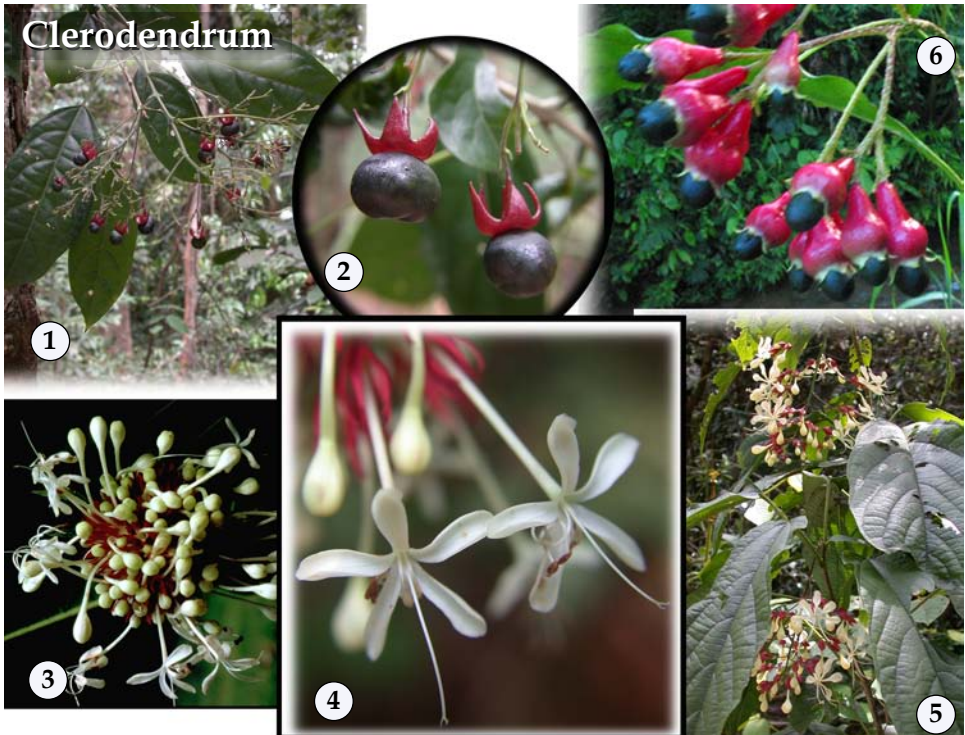
Several other plants can be confused with *Premna* when sterile. *Callicarpa* is somewhat similar in leaf form but is typically densely stellate hairy on the lower leaf surface. Those *Mastixia* (Nyssaceae) with opposite leaves are likewise similar, but they are usually found in the lowland forest understory and the opposite leaves lack a nodal scar. The leaf form and broad coymbose inflorescence can be confused with *Viburnum* (Adoxaceae), but the latter usually has some trace of teeth in the blade

margin and is chiefly in the higher mountains. In Mainland SE Asia, *Premna pyramidata* can be confused with *Mallotus nudiflora* (Euphorbiaceae), but the latter has a much more clearly three-nerved leaf base, stellate hairs and clear small stipules at the node.

☞ - *Clerodendrum* Group - ☞

CLERODENDRUM. [Greek, chance-tree, presumably in reference to the variable efficacy of the medicines, but perhaps better in reference to application in magic.] These beautiful shrubs have been grossly over described with over 800 basionyms at species and sub-specific rank representing maybe 300 species. And yet, there are still many undescribed species to be found in the forests in Asia. Malaya counts only 16, only three on Kinabalu, three or four in Brunei, but in the Philippines 29, Laos 19. A study of molecular data⁷, although with limited sampling, clarified the circumscription of the genus and found three strong clades within *Clerodendrum* itself. One was strictly African, one was Asian and one was pan-tropical coastal; the latter included the common shrub and liana of back mangroves, *C. inerme*,

⁷Steane, D. *et al.* 1999. American Journal of Botany. 86: 98-107.



Clerodendrum. 1-2, *C. laevifolium*, Singapore; 1, opposite simple leaves with weakly 3-nerved base, terminal infructescence; 2, fruit with persistent colored calyx; 3-4, *C. nodosum*, Pasoh; 3, inflorescence, flowers with long thin tubular corolla, colored calyx; 4, flower with long style; 5, *C. cf. infortunatum*, lowland forest, Cambodia; 6, *C. mindorense*, northern Luzon, Philippines, fruit with swollen enlarged calyx base. (Photograph 6, © Leonardo L. Co.)



Clerodendrum laevifolium, Pasoh, herbarium specimen with detail of leaf base.



Clerodendrum aff. *intermedium*, St. Paul National Park, Palawan, Philippines; the flowers with red corolla, gap margin in lowland forest, large opposite palmately nerved leaves.



Peronema canescens. Left, trunk, bark, habit and leaf, of a tree cultivated in the Bogor Botanic Gardens, note the winged rachis; right, drawing adapted from *Der Baumarten von Java*, with details of flower and fruit.



which may soon be segregated anew under the old name *Volkameria inermis*.

Even if the dry land species of Asia prove monophyletic, they are still heterogeneous in leaf form and the details of the flower and fruit. A few species are moderate trees, but many are little more than waist-high shrubs. Many shrubs are similar to *C. paniculatum* in that the leaf is large, broad and strongly palmately nerved, while in small trees such as *C. laevifolium*, the leaf is elliptic and only weakly three-nerved at the base. A few species have a strikingly invaginated leaf, and in a few the blade is rankly odorous. In most all species the calyx is symmetric, but varies in the course of maturation, variously swollen and fleshy or spreading and leafy, often brightly colored.

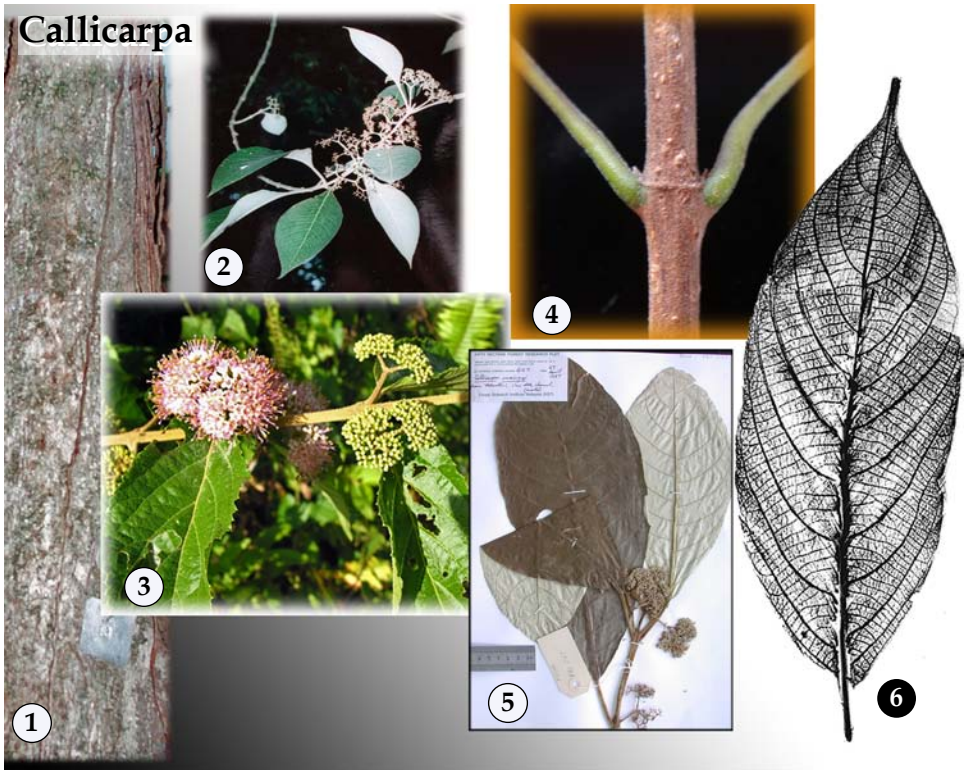
In Malay, they are commonly called *berpanggil*, or some form of *panggil*. More than a few species are cultivated as ornamentals, and many other of our native species could be added to the garden.

GLOSSOCARYA. [Greek, tongue-shaped seed.] Lianas and scrambling shrubs, sometimes free standing; white corolla with long narrow tube, remarkably long stamens; the flower much like *Clerodendrum*, but

the fruit dry and breaking apart with each of four seeds with a basal wing. About 10 species, Mainland SE Asia to Australia, *Glossocarya mollis* in Thailand white lower leaf surface, *G. siamensis* in Vietnam, about two rare in Malaya. (Not illustrated.)

PSEUDOCARYOPTERIS. [Greek, a false *Caryopteris*.] A small genus of aromatic shrubs, three species, Nepal to China, with *Pseudocaryopteris paniculatum* at least reaching northern Thailand. The leaves are pinnately nerved the margin more or less toothed, the inflorescences are axillary near the twig tips or terminal and paniculate; the flowers are subtended by bracts. This is a segregate of the broader *Caryopteris* group of southern and western China that includes the cultivated ornamentals. (Not illustrated.)

KAROMIA. [From the location of the type collection in Annam]. This genus was created in 1932 for a singular rare species of Vietnam, *Karomia fragrans*. It was based on specimens *Poilane* 9892 and 17865, from southern Vietnam, the only duplicates of which are evidently in Museum National d'Histoire Naturelle in Paris. Those two specimens are about all that is known of this odd



Callicarpa. 1-2, *C. tomentosa*, Sumatran origin, Bogor Botanic Gardens; 1, typical gray shredding bark; 2, opposite pinnately nerved leaves, here white below with loose axillary inflorescence; 3-4, *C. formosanum*, Philippines, toothed margin and dense axillary floral clusters; 5, *Callicarpa maingayi*, herbarium specimen of flowering twig, Pasoh, Malaya, note the dense inflorescence and white lower leaf surface; 6, *C. pentandra*, Lambir, Sarawak, showing leaf venation. (Photograph 3, © Leonardo L. Co.)

plant. In the *Illustrated Flora of Vietnam*, Pham Hoang Ho gives a sketch, presumably based on those specimens, which shows a flat orbicular calyx about three cm wide, and describes the flower as deep blue, the tree to 15 m tall.

In the 1980s, added to this species was a group of eight species from Africa and Madagascar, species formerly under the genus *Holmskioldia*, which is significant not only in the geographic disjunction, but also because these African species are very well known, chiefly on account of the widely planted cultivated species, *Karomia speciosa*. They too are distinguished by a persistent, wide and colorful calyx. Whether or not the synonymy was sound remains untested. (Not illustrated.)

☞ - Unplaced - ☞

PERONEMA. [Greek, deficient-threads, in reference to the missing stamens]. Monotypic, *Peronema canescens*, widely distributed at present from Myanmar east throughout most of the dry seasonal parts of Indonesia, with an uncertain natural distribution owing to cultivation and easy dissemination. It differs from *Vitex* in the pinnately compound leaf, with opposite leaflets, a terminal leaflet and a winged leaf stalk. The decussate arrangement identifies the tree from other trees that have a similar-looking leaf. This medium-sized tree is well known in Indonesia as *sungkai* where it is sometimes

used in reforestation and occasional plantations. It is a fast-growing pioneer.

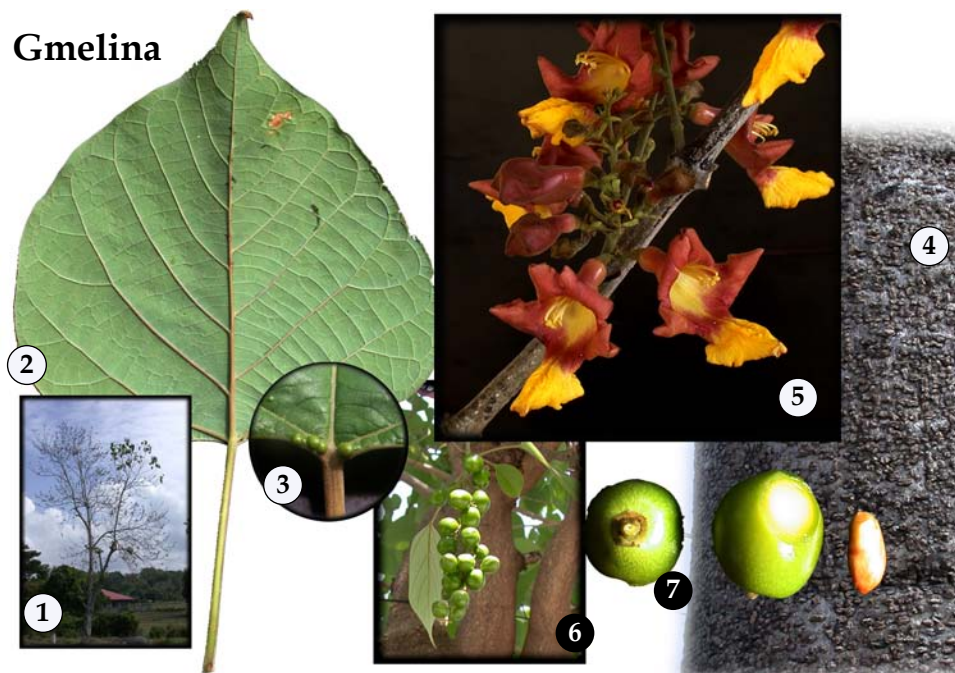
CALLICARPA. [Greek, beautiful-fruit]. 140 species, (including *Genusia*) pantropical and subtropical; 37 in the Philippines, 23 species in Borneo⁸, over 40 in China, and 12 in Taiwan, only four counted in Laos; eight in Malaya. Widely known in Malay as *tampang*, *tampang besi* or some variant; BURKILL *loc. cit.* suggests that *tampang* indicates that the plants are used medicinally for making plasters. In Sarawak the Iban name *sabar besi* is widespread, probably in reference to the resemblance of the fruit to the gray-blue sheen of new metal. Most are small trees and all have simple leaves, often with teeth, without any swellings in the leaf stalk. At least some of the species have been newly reported as dioecious in species outside our region. The tropical species are easily accessible and commonly in flower and yet their biology has been little studied. The Bornean species have been recently revised.

GMELINA. [Commemorates Johann G. Gmelin, d. 1755, leading German botanist, student of Siberian flora.] 35 species, two in Africa, and scattered from India to Australia and New Caledonia with seven in S China, eight in Laos, three in the Philippines; in Malaya only *G. elliptica* in sandy open country and wastelands.

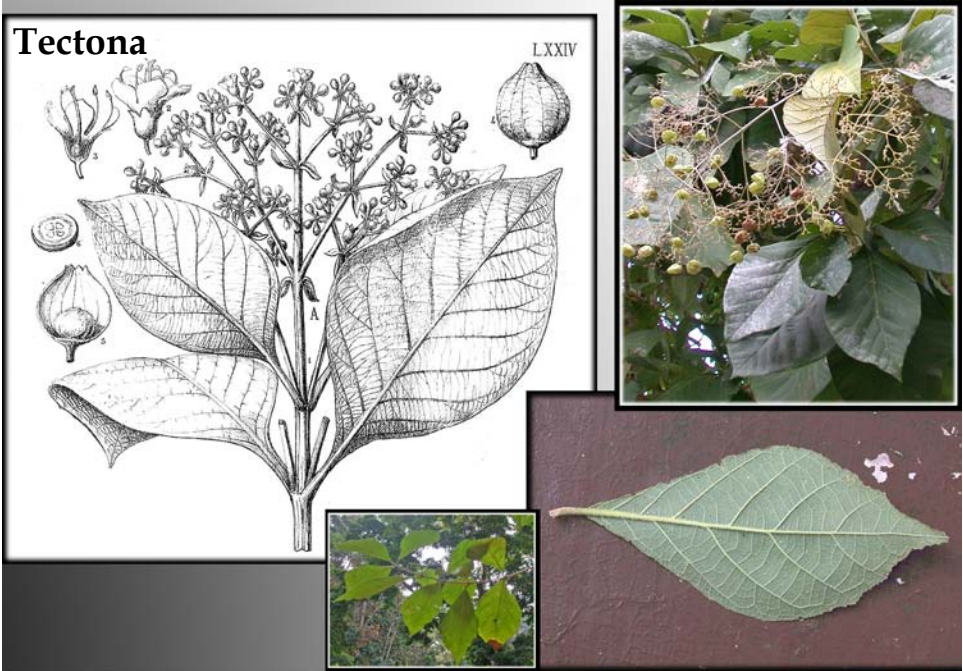
These are small and medium fast-growing trees of early successional habitats, often of poor form, scrambling when young, some species with spines. The leaves

⁸Bramley, G. 2009. Botanical Journal of the Linnean Society. 159: 416-455.

Gmelina



Gmelina arborea, cultivated, Philippines. 1, partially deciduous tree in flower; 2, leaf venation; 3, blistered glands at leaf base; 4, gray warty lenticellate bark; 5, flower; 6, cluster of fruit, tree in full leaf; 7, detail of fruit, persistent calyx, thick mesocarp, yellow and soft at maturity, four ovules but often 1 or 2 seeds.



Tectona. Upper left, drawing of *T. grandis*, inflorescence, flower and dry inflated fruit; upper right, leaves and fruit; lower right, leaf habit and detail of the blade *T. philippinensis*, Mt. Makling, Philippines. (Drawing adapted from VIDAL *loc. cit.*)



Tectona grandis, in flower, cultivated on the margin of rice field, northern Luzon, Philippines.

A traditional art of Thailand is the form of elephants carved in Teak wood; this example is 42 cm tall, from the vicinity of Chiang Mai.

are generally entire, opposite and either pinnately nerved or with a three-nerved base, but with flowers like a large version of *Vitex*. (*Gmelina* is included in the Viticoideae by Harley *et al.*) The blade bears large blistered glands near the leaf base and the lower surface is a bit mealy white. Species with three-nerved base might be confuse with opposite leaves *Mallotus* (Euphorbiaceae), especially *Mallotus nudiflora*.

Gmelina arborea is native to India and dry-seasonal Mainland SE Asia. The trees grows with such of cultivation on degraded land, and fruits so abundantly, that it has become a popular tree in all seasonal places in tropical Asia. It is at least weakly naturalized. Although it can be a large tree in India, the cultivated trees are often of poor form and are rarely left to reach maximum size. The flowers open in the morning and smell of lemon.

TECTONA. [Greek, carpenter, in reference to the wood, valued since ancient times.] Three species restricted to tropical Asia. *Tectona hamiltoniana* is restricted to central Myanmar; *T. philippinensis* a small tree found only in Luzon Island, Philippines, sometimes called there *malapangit*. *Tectona grandis*, the teak of commerce, is probably native to the area between north India and western Mainland SE Asia, but is today cultivated very

widely and seems to naturalize with ease anywhere there is a strong dry season.

Teak forms a key part of the natural forest system in the seasonal Mainland SE Asia; described as either wet teak forests (1500-2500 mm rain per year) or dry teak forests (750-1500 mm of rain per year), although both are strongly seasonal. Sometimes called *kayu jati* in Indonesia, but the name teak is fairly universal now.

Teak is a medium sized tree in height, and can reach a diameter of nearly one m. It has a pronounced deciduous habit. Cultivated examples are widely available for study, and once seen it is unmistakable. A considerable literature is available on teak silviculture and cultivation.

HYMENOPYRAMIS. [Greek, membrane and pyramid, in reference to the inflated bladderlike calyx.] About six species, from India to China, Mainland SE Asia to Malaya. Most often, these grow as scrambling low lianas, sometimes as small trees. When in fruit, they are completely distinctive on account of the inflated calyx that surround the fruit, bladderlike and translucent. (Not illustrated.)

#

ASTERIDS (LAMIIDS): LAMIALES

VERBENACEAE

NAME: From the genus *Verben*.

OVERVIEW: Now treated as a smaller family of 30 genera and 1100 species, pantropical to warm Temperate in distribution, and mostly in the New World, especially the largely herbaceous *Verben* (250), *Lippia* (200) and *Lantana* (150). (See Lamiaceae for the new alignment of genera that were formerly here, and note that *Avicennia* is now in Acanthaceae). The chief and most accesible representatives in Asia are the ubiquitous shrubby weeds of *Lantana*, and the invasive herb *Stachytarpheta*.

LANTANA. [From a classical name for the unrelated *Viburnum*.] The genus comprises maybe 150 species, especially in tropical Amreica. *Lantana camara* is from America, while *L. indica* is from India.



Lantana camara from America, as a ubiquitous weed of seasonally dry parts of Asia; the stem rarely reaches one cm in diameter.

BIGNONIACEAE

NAME: From the genus *Bignonia*, a monotypic genus (*B. capreolata*) of Southeast North America, commemorating Abbe Bignon, d. 1743, librarian to Louis XIV.

OVERVIEW: Bignoniaceae are easily recognized by the opposite compound leaves that lack stipules but bear a scar between the leaves across the flattened node, by the entire margins of the leaflets, the laminar glands, and by the large, colorful, five-parted, two-lipped bisexual flowers, typically with four stamens, and by the often exceedingly large woody fruit with papery winged seeds. The basic floral plan is similar to other families in the Lamiales. Bignoniaceae differ from Scrophulariaceae in the woody habit, the compound leaves, and the winged seeds that lack endosperm. The family is represented to some extent in most of the tropical world, with a worldwide total of 860 species aggregated in 104 genera that are slowly coalescing toward perhaps 80. The Bignoniaceae are of almost negligible significance in the near equatorial forests of Asia. Brunei, with one of the richest tree floras in the world, may seem too modest in claiming nothing other than two very uncommon species of *Deplanchea*, because *Dolichandrone* is certainly there in the mangroves; and yet on Kinabalu one finds only one liana plus the widespread *Oroxylum* and the uncommon and locally endemic *Radermachera ramiflora*. In the Philippines, the Bignoniaceae tree flora has been reduced through synonymy to three genera and five species to which we add only the single liana *Nycticalos cuspidata*. With such paucity, the family might be dealt with in this volume in a perfunctory manner. However, several factors recommend a longer statement. The family is species-rich and ecologically significant in Mainland SE Asia, where 11 genera and more than 50 species are found. Also, it is abundantly represented in all cities by numerous cultivated species, these being dangerous to the student in so far as these are almost all exotics that represent lineages different from the Asian side of the Bignoniaceae and so may invite a somewhat misleading first impression of the family. Furthermore, much that was previously written of Bignoniaceae is inaccurate in the light of new phylogeny.

A recent phylogeny of the family confirms and advances the important findings from previous work. Most of the morphological diversity lies in tropical America. The Asian taxa are chiefly of a clade surrounding *Stereospermum* and *Radermachera*, represented by nine genera

and about 45 species. These were at one time placed in an overly broad tribe called Tecomeae which led to the common description of the family as evincing parallel representation in the Americas and Asia. They do not. There is nothing in Asia comparable to *Tabebuia*, nor to the rich and abundant lianas of Bignoniaceae.

Ecologically, the Bignoniaceae in Asia are chiefly trees of the dry-seasonal parts of Mainland SE Asia where they are abundant and ecologically important as early successional species of the semi-evergreen forests and more stable elements of the dry-seasonal forests. The representation in the lowland equatorial lands to the south and east is limited to the widespread mangrove *Dolichandrone*, a few lianas such as *Nyctoclados*, the strange roadside tree *Oroxylum*, the enigmatic *Deplanchea bancana* with simple opposite leaves, and a few species of *Radermachera*.

This pattern of richness and abundance in the west and relative poverty to the east evinces parallels with the Lythraceae. Both families comprise fast-growing trees of the full sun, large-flowered and wind-dispersed. Both families are all but unknown in the lowland wet equatorial forests. Each family includes one or more species of mangroves: *Sonneratia* (Lythraceae) and *Dolichodrone* in the Bignoniaceae.

Bignoniaceae are well known for the diversity of its pollination syndromes. Among Asian trees, we find pollination by birds in *Fernandoa*, bats in *Oroxylum*, nocturnal moths in *Dolichandrone*, while butterflies are easily seen in *Deplanchea*. Perhaps large bees are the most common pollinator. Dispersal is generally by wind, the dry fruit walls split and spread, the papery winged seeds float far and wide in the dry season. The only variant in Asia appears to be the corky seeds of the mangrove *Dolichandrone* which certainly float. We have no fleshy indehiscent fruits such as we find in the American *Crescentia*.

Odd that the family, characterized in Asia by fast-growth and extremely light wood, includes among the American *Tabebuia* species some of the heaviest and hardest of timbers. The Bignoniaceae are much used in India and Mainland SE Asia in traditional medicine, especially bark and root wood. In a few species, the flowers

FIELD RECOGNITION

No exudate, no odor.

Opposite compound leaves: in most genera, once cut with strictly opposite leaflets and a terminal leaflet; a few important species are thrice-cut, and the uncommon *Deplanchea bancana* is simple leaved (or a single terminal leaflet).

No true stipule, but a scar across the flattened node and some stipule-like leaflets are common.

The leaflets with laminar glands.

Often soft wood, the trees poorly formed with messy crowns, some of India-Mainland SE Asia flowering leafless.

FIELD CONFUSION

Other opposite pinnately compound leaves (*Turpinia*, *Sambucus*, *Peronema*, *Weinmannia*, *Fraxinus*) all have toothed margins.

Melicope - Rutaceae odor

¹Olmstead, R. et al. 2009. American Journal of Botany 96(9): 000-000.

²Spangler, R. et al. 1999. Annals of the Missouri Botanic Gardens. 86: 33-46.

³Zjhra, M. et al. 2004. Plant Systematics and Evolution. 245: 55-67.

⁴Fischer, E. et al. 2004. The Families And Genera Of Vascular Plants. 7: 9-38.

⁵Santisuk, T. 1987. Flora of Thailand. 5: 32-66.

Phylogeny of Bignoniaceae

The following phylogeny of the Bignoniaceae is adapted from Olmstead *et al.* 2009 as cited in the introduction. Its inclusion may seem inappropriate in that only three of the identified clades are represented among the trees of Tropical Asia. And yet that is an important point to make in two respects. First, the species of Bignoniaceae that comprise such an important part of the dry seasonal forests of Mainland SE Asia represent only a small part of the family diversity. Second, that for many students, the most likely first encounter with the family Bignoniaceae will be with the widespread and abundant cultivated species: *Tecoma stans*, *Jacaranda*, *Tabebuia* and *Spathodea*, and only the last of these is a part of the Palaeotropical clade.

Clade	Diversity and Distribution	Trees of Tropical Asia
Jacarandae	2/55, Neotropical.	0
Tourrettieae	2/, herbaceous vines, Neotropics.	0
Tecomeae	12/55, scattered Old and New World, <i>Campsis</i> in China, 4 genera in Australia, <i>Deplanchia</i> reaching west, otherwise not in tropical Asia.	1/2, <i>Deplanchia</i> to Borneo and Malaya.
Oroxyleae	4/6, Indomalayan.	2/2,
Crescentini		
Paleotropical Clade	<i>Stereospermum</i> , etc.	20/150
Coleeae	4-5/55, Madagascar.	0
<i>Tabebuia</i> alliance	<i>Tabebuia</i> etc.	14/147, Neotropics.
Crescentieae	3/35, Neotropics.	0
Catalpeae	2-3/11, E Asia and N America.	0
Bignoniaceae	20-40/377, Neotropical, especially lianas.	0

are eaten in the manner of the legume *Sesbania* (Fabaceae).

Although Bignoniaceae are among the most widely cultivated of all tropical trees, the Asian representatives have contributed few, and our most popular cultivated species originate from America (*Tecoma stans*, *Jacaranda mimosifolia*, *Tabebuia*, and the calabash tree, *Crescentia cujete*), and from Africa (*Spathodea campanulata*). From Asia, only perhaps *Millingtonia* is often grown, and only in Mainland SE Asia.

The knowledge of the Asian Bignoniaceae is fairly complete with regard to the main species, but exceedingly weak with regard to the details of form, ecology and phylogeny. Molecular study of phylogeny is much needed, as is better descriptions of the trees as they grow, especially the bark and growth habits, the phenology, and pollination. The more common species of Northern Thailand are well-illustrated in GARDNER *loc. cit.*

DEPLANCHEA. [Commemorates EF Deplanche d. 1874, French naturalist.] Usually described as bearing simple leaves in whorls; it might be better seen as being an ordinary species of Bignoniaceae with the leaf reduced to the ultimate leaflet. The arrangement certainly appears to involve two-four leaves at a node and it would merit developmental studies in regard to the contrast with the ordinary opposite arrangement of the family. The blade bears the laminar glands that characterize the family. The genus includes four or five species found in a wide area from New Guinea to Australia and New Caledonia, and includes *Deplanchea tetraphylla*, cultivated for the dense inflorescence of golden-yellow flowers. Our main



Deplanchea tetraphylla adapted from Plate 229 of Banks and Solander 's *Illustrations Of The Botany Of Captain Cooks Voyage Round The World*. (drawn by Sydney Parkinson circa 1770, printed in 1901.) Note the dense inflorescence, the paired glands at the leaf base, the indication of more than two leaves per node.

Skeletal Outline of the Bignoniaceae in Tropical Asia

Note that van Steenis described *Lamiodendron magnificum* from New Guinea, (calx regular five-lobed rather than the irregular calyx of most *Radermachera*.)

Mainland SE Asia

Compound leaf cut 2-4 times	
<i>Oroxylum</i>	Leaf 3-pinnate, fruit to 1 m, splits parallel to septum (septicidal), flowers red, inflorescence of panicles, 1, <i>O. indicum</i> .
<i>Millingtonia</i>	2-3 pinnate, fruit 30 cm, splits parallel to septum (septicidal), flower white, inflorescence of cymes 1, <i>M. hortensis</i> .
<i>Radermachera</i>	big deciduous or evergreen trees, tubular calyx, capsule 2-angled 18 species, 4 species with 3-compound leaf.
<i>Pauldopia</i>	1, <i>P. ghorta</i> , small tree, 7 m tall, twice-cut leaf, rachis winged, yellow flower, seed almost wingless.
Compound leaf cut once	
<i>Dolichandrone</i>	spathaceous calyx, flower white, 3 species, 1 in mangrove.
<i>Radermachera</i>	18 species total, 3 species with 1-compound leaf, big deciduous or evergreen trees, tubular calyx, capsule 2-angled .
<i>Stereospermum</i>	15 species, 4 in Asia, big deciduous trees, tubular calyx, capsule 4-angled.
<i>Markhamia</i>	10 species in Africa, in Asia only <i>M. stipulata</i> , spathaceous calyx, leafy 'stipules', flowers red or yellow, capsule cylindrical.
<i>Fernandoa</i>	14 species, Africa to India, 2 in tropical Asia, medium trees, spathaceous calyx.
<i>Pajanelia</i>	1, <i>P. longifolia</i> , keeled rachis, tubular calyx, winged capsule.
<i>Heterophragma</i>	2 species, Asia, stellate hairy, verticillate? tubular calyx.
<i>Santisukia</i>	2 species, Thailand, leaflet glabrous, verticillate? tubular calyx.

Sundaic Region and East

Compound leaf cut 2-4 times	
<i>Oroxylum</i>	1, <i>O. indicum</i> , fruit splits parallel to septum (septicidal).
<i>Radermachera</i>	18 species total, big deciduous or evergreen trees, tubular calyx, capsule 2-angled.
Compound leaf cut once	
<i>Dolichandrone</i>	Mangrove, <i>D. spathacea</i> , spathaceous calyx, flower white.
<i>Radermachera</i>	3 species with 1-compound leaf, big deciduous or evergreen trees, tubular calyx, capsule 2-angled.
Simple leaf	
<i>Deplanchea</i>	Simple leaf, tubular calyx, 5 species, esp. New Guinea to Australia and New Caledonia 1, <i>D. bancana</i> .

species, *D. bancana*, might be seen as a wayward child that drifted west from its native home in New Guinea and beyond. This is a medium-sized tree, wind dispersed and gap regenerative, perhaps more common in the low swampy forests of Malaya, Sumatra and Borneo than might be indicated by the sparse collections. Trees of this name are sometimes reported from the highlands of Borneo, but these mountain trees might be better aligned with the New Guinean *D. glabra*. The apparent absence of the genus in the Philippines is noteworthy.

OROXYLUM. [Greek, mountain-tree, inaccurate reference to the presumed habitat.] Monotypic, *Oroxylum indicum*, and notably uniform despite the exceedingly wide distribution from Sri Lanka and India to China and all of tropical Asia. A strangely misproportioned tree. The trunk is rarely more than 10-15 cm DBH, but even on small individuals the thrice-pinnately compound leaves are enormous, the fruit appears impossibly large, sometimes approaching one m in length. The flower differs from many Bignoniaceae in several ways, some perhaps related to bat pollination; the inflorescence is compact and almost spike-like while the short



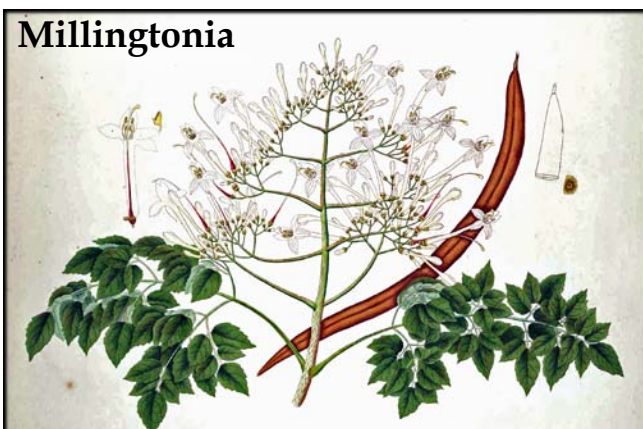
Oroxyllum indicum, here in the Philippines; on the left a single leaf, thrice-cut compound, with a mature fruit nearly 1 m long; background the individual leaflets are shown; in the center, fruit and seed; to the right the inflorescence. (Drawing adapted from BLANCO *loc. cit.*)

thick floral tube is maroon in color; and the stamens with two-celled anthers number five rather than four, the nocturnal odor is musky and fetid. The genus is also distinguished by the septical rather than loculicidal fruit. CORNER *loc. cit.* offers a colorful description of the little that is known of its ecology, while two recent studies provide details of the bat pollination in Thailand and India. The tree enters into various applications in traditional medicines.

MILLINGTONIA. [Commemorates Sir Thomas Millington, d. 1704, clarified the sexual function of floral parts.] A single species, *Millingtonia hortensis*, found from India to S China and Mainland SE Asia. This is small tree, often poorly formed, as most Bignoniaceae are, but with dense attractive clusters of white flowers, erect as they develop, but sometimes pendent when they bloom. It is often cultivated and its natural distribution is unclear. The leaves are two or three times pin-

nately cut, a form shared with *Oroxyllum* and a few species of *Radermachera*. Also, the genus differs in that the anther bears one fertile cell and the other apparently infertile. The fruit is only a third the size of *Oroxyllum indicum*, but as in that species, it dehisces along the septum.

DOLICHANDRONE. [Greek, in reference to the long stamens.] Nine species, Africa to Australia; four in tropical Asia. White flowers, night blooming, allied with yellow-flowered (and bird pollinated?) *Markhamia*. In *D.*



Millingtonia hortensis, thrice-cut leaves, and clusters of white long-tubed flowers. Adapted from Plate 214 in ROXBURGH *loc. cit.*

Srithongchuy *et al.* 2008. Journal of Tropical Ecology. 24: 477-484.
Vikas, M. *et al.* 2009. Journal of Tropical Ecology. 25:93-96.

Dolichandrone



Dolichandrone spathacea, the ubiquitous Asian mangrove, here in the Philippines; 1, the gray, warty lenticellate bark of a fully mature tree, 12 cm DBH; 2, the flower just beginning to bloom, 3 hours after sunset, note the single spathe-like calyx lobe, and note the ants around the mouth of the corolla; 3, the mature fruit splits to drop the corky rectangular seeds. 4, the leaflet with the scattered pellucid glands; 5, the twig tip and node, showing the paired leaves the leaf stalks joined to protect the apex, an arrangement that results in a scar across the flattened node, all features typical of the family.

spathacea, the stigma consists of two lobes, far extended beyond the floral tube, and mechanically sensitive such that the lobes close within seconds of being touched. In this way they receive foreign pollen when a visitor first approaches the flower, but will not be contaminated as the visitor leaves with pollen from the flowers own stamens.

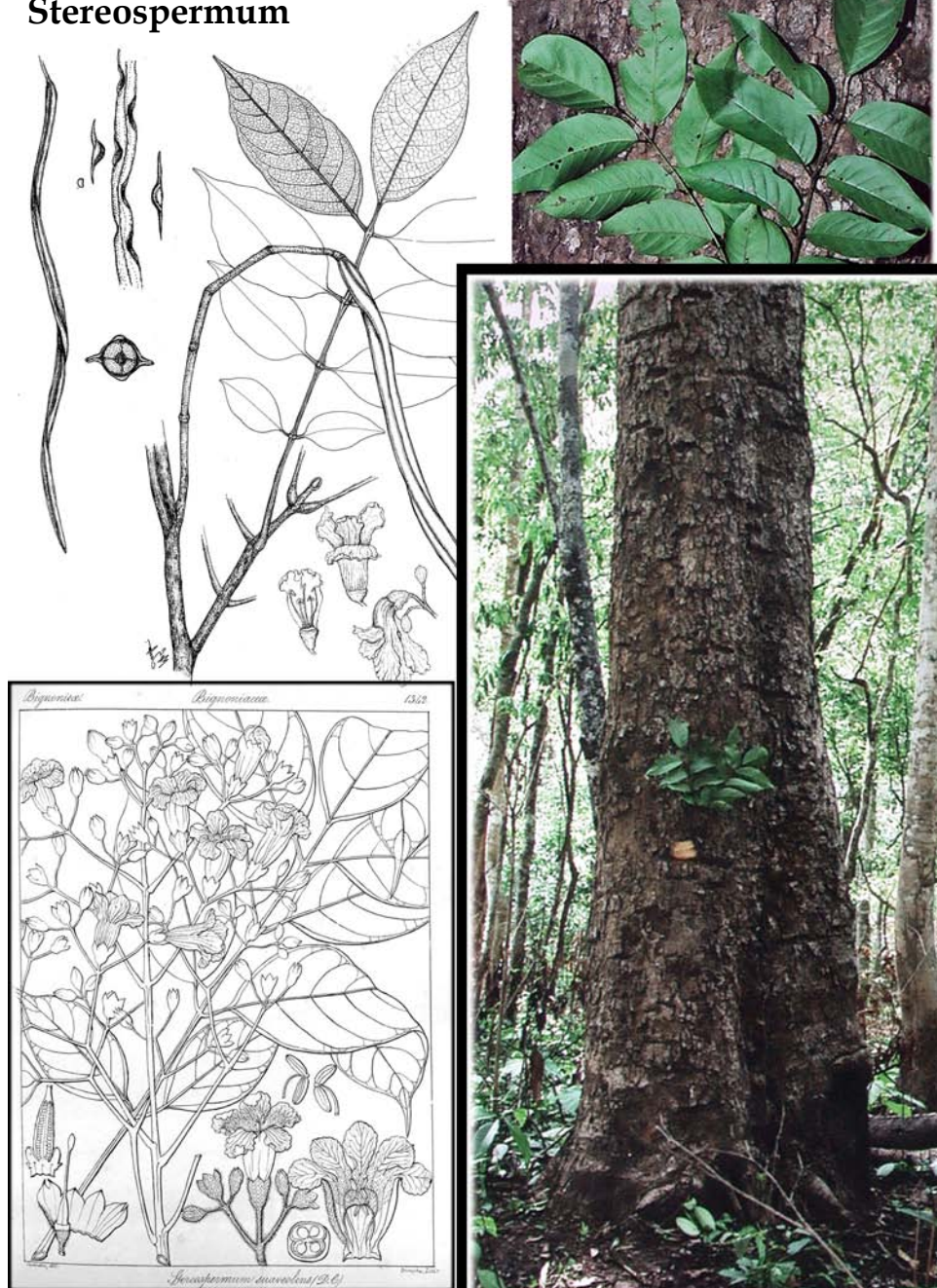
STEREOSPERMUM. [Greek, in reference to the thickened seed of some species.] 15 species, tropical Asia, tropical Africa; three species in China. Trees deciduous; leaves once-cut compound; leaflets entire; glands in lower panels. The inflorescence is terminal, a sparse open panicle. The calyx is usually short and broad, notably lobed or nearly truncate; the corolla lobed and sometimes dramatic, with fringes, colored white and red or yellow. Stamens four. Capsule dehiscent loculicidally, terete, slender, four-angular; septum terete, woody. Seeds inserted in septum, transparent and membranous winged at both ends. *Stereospermum colais* can be a large diameter, although short in stature.

MARKHAMIA. [Commemorates Sir Clements Markham, d. 1916, British scientist, explorer, plant

collector, introduced *Cinchona* to India.] 10, mostly tropical Africa with one species, *M. stipulata* in tropical Asia. Trees, once-cut pinnately compound leaves, rough brown hairy, leaflets are stalkless, the blades with laminar glands near the lower nerves, the axillary branches condensed forming stipule like clusters at the leaf base; The inflorescence is terminal, calyx spathe-like and divided to the base, variously near glabrous to densely woolly (described as varieties); Corolla lobes five, subequal, rounded, tube short, yellow or yellow-red; stamens four. Capsule terete, compressed, yellow-brown floccose to lanate-woolly, dehiscent loculicidally, winged seeds long ellipsoid, two-rowed in each locule. A small tree of open places and secondary forests from India to Mainland SE Asia.

PAULDOPIA. [Commemorates French botanist of Indochina Paul Dop, d. 1954.] Monotypic, *Pauldopia ghorta*, from India to Mainland SE Asia. Small tree, opposite compound leaves are twice-cut and the rachis narrowly winged, the leaflets nearly sessile. Inflorescence is a pendent compact cluster of bright yellow flowers with a relatively short and wide floral tube. The capsule is

Stereospermum



Stereospermum. Upper left, drawing of *S. colais*, Huai Kha Khaeng, Thailand, leaf, flower and fruit detail (c BUNYAVECHJEWIN loc. cit.); upper right and lower left, photographs of the same; lower right, *S. suaveolens*, leaves and floral details, adapted from WIGHT loc. cit.

nearly round in cross-section, while the seeds are thick and nearly wingless. (Not illustrated.)

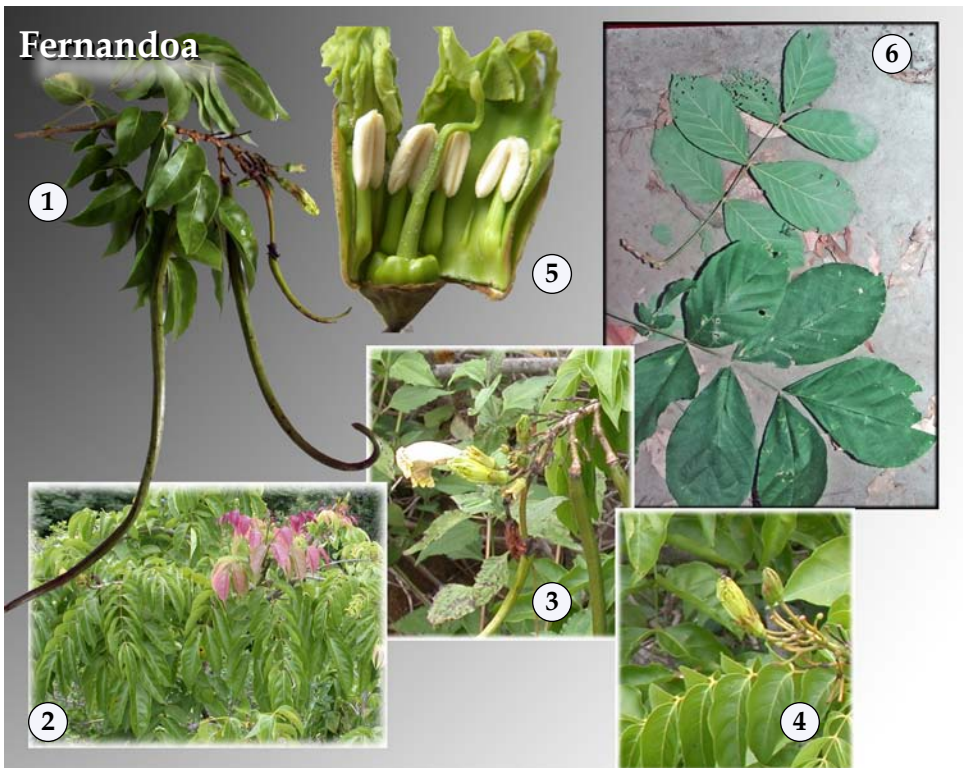
FERNANDOA. [Commemorates Don Fernando, King of Portugal.] About 14 species: four in tropical Africa, three in Madagascar, six from India to China and Mainland SE Asia, *F. adenophylla* as far south as Langkawi. The leaves pinnately compound, once-cut, the leaflets bear hairy domatia in the nerve axils on the lower leaf surface. The calyx is persistent in fruit.

PAJANELIA. [From an Indian name.] Monotypic, *P. longifolia* from India to Mainland SE Asia. This tree is beautifully illustrated in the Biotik web site that describes trees of the Western Ghats. This is a large and tall well-butressed tree, deciduous, with clustered rosettes of pinnately compound leaves at the ends of long leafless branches. From a distance, it takes on the appearance of *Polyscias* (Araliaceae). The flower has a relatively short corolla tube. (Not illustrated.)

Trees of the Western Ghats. (<http://www.biotik.org>)
Sandwith, N. 1967. Kew Bulletin. 21: 21-30.

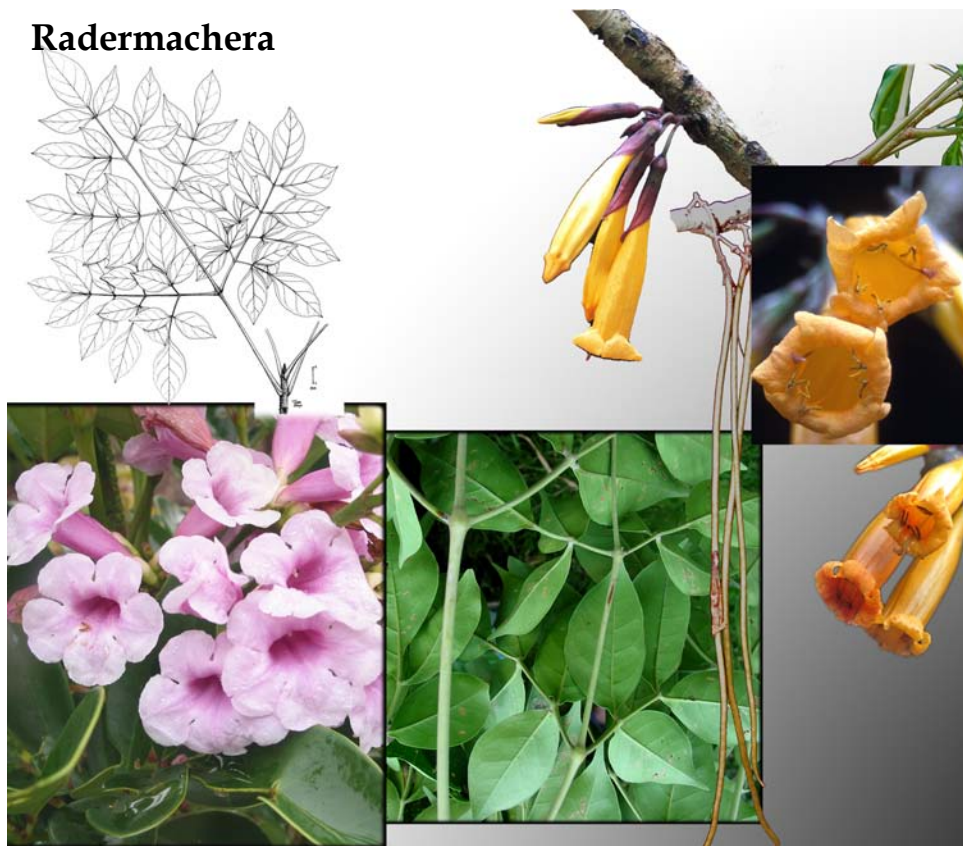
SANTISUKIA. [In honor of Santisuk Tawatchai, student of Thai Bignoniaceae, former Director of Royal Thai Forest Department Herbarium.] A small genus of only two species, *Santisukia pagettii* and *S. kerrii*. They are restricted to Thailand, and known by little more than a few collections and hardly distinguished from *Radermachera* except that the leaves form remarkable whorls of two or three pairs. They are described as 'verticillate', which would imply that the leaves are not paired but rather inserted at exactly the same point. The illustration and photograph of the flowers in the description of Thai Bignoniaceae cited in the introduction does not clearly indicate the organization. A study of development would be of interest; the phylogenetic study by Olmstead et al. suggests that *Santisukia*, which was not sampled for molecular data, may be better placed in the new narrowly defined *Tecoma* tribe.

HETEROPHRAGMA. [Greek, in reference to the different partitioning? of the fruit.] *Heterophragma sulfureum* and *H. quadriloculare*, India, Mainland SE Asia, deciduous trees, flowering leafless, corolla white to yellow, leaves in clusters, lower leaf surface stellate hairy. The leaves in clustered pairs, and most critically, the broad sausage-shaped fruit in cross section shows four



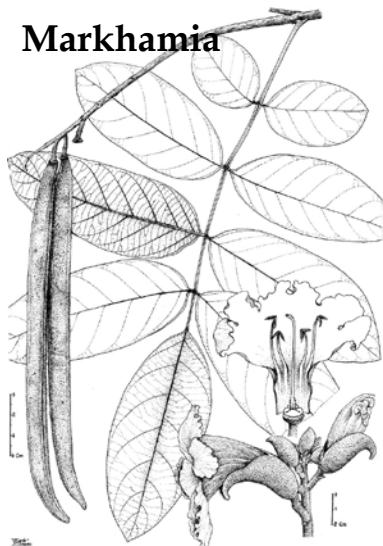
Fernandoa. 1-5, *F. collignonii*, lowlands, central Vietnam; 1, the curved fruit with about 3 ridges; 2, habit as a small tree, note the flush of new violet leaves; 3-4, nearly open flower, bright yellow, short broad tube, the calyx with 3-5 short pointed lobes; 5, a young flower bud, opened; 6, the leaves of *F. adenophylla*, Huai Kha Khaeng, Thailand, note the small lowermost leaflets.

Radermachera



Radermachera. Upper left, line drawing of the leaf of *R. ignea*, Thailand, 2-3 times compound; right, flowers and fruit of *R. ignea*, Thailand; center, leaf of *R. pinnata*, Luzon, Philippines; lower left, flowers of *R. gigantea*, Philippines. (Drawings and photographs from Thailand BUNYAVEJCHEWIN *loc. cit.*; photographs from Philippines, © Leonardo L. Co.)

Markhamia



Markhamia stipulacea, line drawing from BUNYAVEJCHEWIN *loc. cit.*

arms. Illustrated in GARDNER *loc. cit.*, see the notes by Sandwith regarding the genus. *H. quadrilobulare*

RADERMACHERA. [Commemorates J. Radermacher, d. 1783, a Dutch patron of Indonesian science.] A genus of about 16 species, tropical Asia. Certainly a heterogeneous group, possibly not monophyletic, without absolutely uniform and decisive features., *Radermachera ignea* (sometimes as *Mayodendron ignea*), *R. gigantea* is a notable species group of the Philippines, including six synonyms by either Merrill and Elmer representing island endemics.

A -- Cultivated Bignoniaceae -- a

A great many Bignoniaceae are cultivated in tropical Asia for their large colorful flowers. *Spathodea campanulata* may be the most abundant, but *Jacaranda*, *Tecoma*, and *Tabebuia* found in almost of the larger cities. Most of these species form fruit at least occasionally, and have the potential to become serious pests. *Spathodea* is invasive in Cuba.



Spathodea capanulata, the African tulip tree, cultivated widely, here in the Philippines; note the laminar glands at the leaflet base, characteristic of the family.

#

ASTERIDS (LAMIIDS): LAMIALES
GESNERIACEAE

NAME: From the genus *Gesneria*, a genus of tropical herbs, the name of which commemorates Swiss naturalist Conrad Gessner, d. 1565, author of *Historiae Animalium*. They are most commonly known in English as the African Violet family.

OVERVIEW: The gesneriads are a large family of herbs and lianas with about 150 genera and 3200 species. They share with other Lamiales opposite sometimes toothed leaves and an asymmetric lipped flower. They differ in an inflorescence of paired flowers. The ovary varies from superior to half-inferior to inferior while the fruit is either a dry dehiscent capsule or a fleshy berry, typically with a great many seeds. The traditional distinction with Scrophulariaceae is a unilocular ovary with parietal placentation rather than a bilocular ovary and axile placentation.

CYRTANDRA. [Greek, in reference to the curved stamens.] Maybe 500 or more species, with centers of species richness from Borneo north and eastward to Hawaii including secondarily woody species. About 16 or so on Kinabalu, maybe five of which could be called small trees, reaching two m or so in height and two cm DBH; Malaya claims about 13 species, maybe three as shrubs, MERRILL *loc. cit.* (as updated by Leonardo Co) enumerates over 100 species for the Philippines, of which maybe 10 to 15 species reach 1-3 cm DBH. Most of the



Cyrtandra. The characteristic features of the genus are illustrated here by the Philippine endemic, *C. oblongata*, from the forest plot in Palanan, Isabela, Philippines. The stem barely reaches 2 cm DBH, the paired leaves are clustered at the top of the single main axis; the flowers are large and paired from the leaf axil. (Photographs © Leonardo L. Co.)

shrubs are of the *schoepfbaum* habit - a single upright stem with a dense rosette of opposite leaves, often collecting leaf litter in the small canopy.

ASTERIDS (LAMIIDS): LAMIALES

SCROPHULARIACEAE

NAME: From the genus *Scrophularia*, 200 species of North Temperate herbs; in English as the Figwort or Foxglove family.

OVERVIEW: A family of some 27 genera and 1400 species distributed over the globe, but especially in the North Temperate Zone, especially herbs and multi-branched shrubs, including many ornamentals. The family has been greatly changed in composition from the conception of a century ago¹. The tropical Asian representatives are chiefly a diverse collection of herbs, especially in the cooler wet places. Yamazaki² notes 30 genera and 106 species in Thailand, while in the Philippines we find about 23 genera and 50 species. The Asian genera of woody plants (*Wightia*, *Brandisia* and sometimes including *Paulownia*) are traditionally close to Bignoniaceae and are sometimes under that family in regional literature, while *Buddleja* is often in the Loganaceae or isolated in its own family.

BUDDLEJA. [Commemorates Adam Buddle, 1660-1715, wrote a completely new English Flora in 1708, never published, but extensively copied. Note that the

letter 'j' is objectionable in the name, but that most people accept this spelling as first used by Linnaeus.] *Buddleja* is a genus now broadened to include several related genera, with 40 Old World species and 60 species in the New World. In our region, it is represented almost exclusively by *Buddleja asiatica*. The ecology of this small shrub is full of interest. While it is almost always a plant of the full sun, often in disturbed places, it can be found from near sea level to nearly 2000 m elevation. The open habitat and the opposite narrow leaves with bright white lower surface make the plant readily recognizable. Often enough it is also in flower.

BROOKEA. [Commemorates Sir James Brooke, 19th Century founding ruler of Sarawak.] Four species of large herbs or small shrubs, endemic to Borneo. Poorly known and rarely collected, but see the new species by Yamazaki³.

WIGHTIA. [Commemorates Robert Wight, d. 1872, Scottish botanist of India, author of *Icones Plantarum Indicae Orientalis*, etc.] Do not confuse the name with *Wrightia* of the Apocynaceae. *Wightia* is a genus of two species of the Himalayas. *Wightia speciosissima* reaches at least N Thailand at elevations of over 1000 m, recorded from Doi Inthanon and Doi Chiang Dao, etc. (See the description and photograph in Yamazaki's family treatment for Thailand² and also the excellent illustrations in GARDNER *loc cit.*) This is a small tree, often as an epiphytic shrub, with opposite leathery leaves. The pink

¹Olmstead, R. 2002. *Fremontia*. 30: 13-22.

²Yamazaki, T. 1990. *Flora of Thailand*. 5: 139-238.

³Yamazaki, T. 1994. *Journal of Japanese Botany*. 69: 282-284.

Buddleja



Buddleja. Photograph on left is *B. asiatica*, from 1800 m elevation, Central Highlands of Vietnam; photograph in the center is the same from Cuernos, Negros Island, Philippines; drawing on the right is described as from India with details of flower and fruit. (Center photograph © Leonardo L. Co; drawing adapted from Robert Wight's *Icones Plantarum Indiae Orientalis*, Vol. 4.)

corolla is up to 3.5 cm long with a short tube, the lower lip three-lobed; upper lip two-lobed; the fruit is a long (to four cm) dehiscent capsule with numerous seeds that bear a thin membranous wing. *Wightia borneensis* is a small woody plant, of scattered location and habit, as shrub a Borneo, as an epiphyte in Malaya. The twigs are hollow and it is a suspected mymecophyte. (Not illustrated.)

BRANDISIA. [Commemorates Dietrich Brandis, d. 1907, German botanist and father of Asian tropical forest science, who at the age of 75 began his most famous botanical work, *Indian Trees*, dealing with 4400 species.] About nine species of the Himalayas, to India and China, with one species, *Brandisia discolor*, reaching the northernmost mountains of Mainland SE Asia. Again, see Yamazaki² for description and illustration.



Brookea. The herbarium voucher of *B. tomentosa*, a small shrub collected in Brunei. (Photograph © Professor Eizi Suzuki.)

#

ASTERIDS (LAMIIDS): LAMIALES

PAULOWNIACEAE

NAME: From the genus *Paulownia*, as below.

OVERVIEW: A family of a single genus, sometimes left within the Scrophulariaceae.

PAULOWNIA. [Commemorates Queen Anna Pavlovna of The Netherlands, d. 1865, daughter of Tsar Paul I of Russia.] This genus is usually treated as a variable group of six to 17 species of China and East Asia, with one species, *Paulownia fortunei*, found southward to

northern Laos and Vietnam. Although barely entering our region, it is a tree of interest because of the relative fast growth and its increasingly common use in plantations and reforestation. This is a deciduous tree reaching 30 m in height, 20-50 cm DBH, although noted in Vietnam literature as exceeding 200 cm DBH in old protected trees. The opposite leaves are up to 40 cm broad. The large purple flowers are especially conspicuous in the large terminal inflorescences. The fruit is a dehiscent capsule with many small seeds. We might note that the ornamental *Paulownia tomentosa* is now listed as an invasive species in the southeastern United States. The wood is pale, straight-grained and attractive; it is general utility, but also seems to have found a niche in the making of surfboards.

#

ASTERIDS (LAMIIDS): Unplaced

BORAGINACEAE

NAME: From the small genus of European herbs, *Borago*.

OVERVIEW: About 150 genera and 2500 species. Especially 30-20 degrees N latitude, especially Mediterranean and especially herbs. The family broadly inclusive is monophyletic with several component clades, the most

important of which for us is what is informally termed the 'Woody Boraginaceae' comprising especially *Ehretia* and *Cordia*. (See the cited molecular phylogenies and the papers cited therein^{1,2}.) The family is weakly represented among tropical Asian trees, but some important trees are found in Africa and America. The species within the *Flora Malesiana* area have been treated³. The plant body is often with stiff hairs from a basal cystolith. Leaves simple, exstipulate, alternate-spiral, rarely opposite, entire or serrate margin. Inflorescences often double scorpioid cymes. The flowers commonly bisexual, actinomorphic with parts in fives, the calyx lobes overlapping and often persistent in fruit. The five-part corolla is basally fused and variously shaped, often salveriform, and often weakly differentiated among species within a genus. The stamens number five, usually inserted on corolla tube alternate with the lobes; the anthers two-loculed, and dehiscent by slits. The supe-

¹Gottschling, M. *et al.* 2001. Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie. 123: 249-268.
²Gottschling, M. *et al.* 2005. Annals of the Missouri Botanical Garden. 92: 425-437.
³Riedl, H. 1997. Flora Malesiana. 13: 43-144